This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

COUNTWAY LIBRARY
HC 2VW8 G

ASTHMA

ITS RADICAL TREATMENT

B. HOEBER
DICAL BOOKS
59th St., N.Y.

ASTHMA

Read important II p 166

ASTHMA

AND

ITS RADICAL TREATMENT

BY

JAMES ADAM, M.A., M.D., F.R.F.P.S.,
HAMILTON.
Dispensary Aural Surgeon, Glasgow Royal Infirmary

WITH FOUR ILLUSTRATIONS

PAUL B. HOEBER,
69, EAST 59TH STREET,
NEW YORK
1913

BOSTON MEDICAL LIBRARY
IN THE
FRANCIS A. COUNTWAY
LIBRARY OF MEDICINE

PREFACE

THE writing of this book has been unduly protracted, and would have been more so but for generous help from friends, to whom I gratefully own my debt. To Dr R. S. M'Kim, assistant aural surgeon, Glasgow Royal Infirmary, for revision of MS.; to Dr J. F. Lang, Larkhall, for help with the proofs; to Dr Agnes Picken, demonstrator in anatomy, women's department, Glasgow University, for compiling the index.

I desire also to express my thanks to Professor Walker Hall for the use of his diagram on nucleo-proteid changes ("Purin Bodies"); and for the long quotation on asthmatic sputum to Dr Emerson and to his publishers, Messrs Lippincott ("Clinical Diagnosis").

CONTENTS

CHAPTER PAGE

I. INTRODUCTORY 1

II. THE ACUTE ATTACK . . . 7

III. THE CHRONIC ASTHMATIC . . . 30

IV. THE PERIODICITY OF ASTHMA; THE URINE IN ASTHMA 41

V. ATYPICAL ASTHMA AND ALLIED CONDITIONS 61

VI. ASTHMATIC DYSPNŒA; ITS PATHOLOGY . 75

VII. THE NOSE IN RELATION TO ASTHMA . 89

VIII. ETIOLOGY 104

IX. MORBID ANATOMY, COMPLICATIONS, DIAGNOSIS 116

X. PROGNOSIS 128

XI. TREATMENT 153

REFERENCES 178

INDEX 180

ASTHMA

CHAPTER I

INTRODUCTORY

Of the making of books on asthma there is no end, so that each must bow with an apology before a wearied and naturally sceptical public. What this one has to say for its appearance now, is that it is older than it looks, and that by the present bewildering discord as to the nature and treatment of asthma it has been tempted on to the stage, in order to indicate a plan of treatment which fifteen years of experience have proved to be increasingly successful, and which vindicates the view adopted as to the nature of the disease.

Lack of leisure has prevented the book from being written years ago; for the same reason it does not profess to be a complete account of many interesting and too much neglected phenomena found in asthma. It is founded largely on personal observation, too often imperfect and hurried, but still it is put forward with the hope that it will be useful not only in the treatment of asthma, but also in those other diseased states whose kinship with asthma is too much overlooked.

Of the defects of a book, probably no one can be more aware than its author, but when, as now, it has been necessarily written in snippets of time, often at wide intervals, defects are unavoidable. The main one has remained to me irremediable : the lack of experimental confirmation of the thesis that asthma is toxæmic. Experimental work is debarred to a general practitioner in a country town, where most of my observation has been made, but I have tried to bring together as much clinical support as possible for the thesis which seems to me amply confirmed in the best of ways—namely, by therapeutical success.

The book is an expansion of post-graduate lectures delivered in 1910 at Glasgow Royal Infirmary ; these in turn were based on a thesis written in 1900, and published in Glasgow Hospital Reports, 1901.[1] The view expressed twelve years ago was that asthma resulted from two factors—a toxæmia and a lesion in the respiratory tract, oftenest in the nose. This view experience has taught me to modify to the extent that I should now put much the greater emphasis on the toxæmia, though the respiratory and nasal factor is still important.

To label diseases toxæmic has unfortunately become too much a vogue in medicine, but in the case of asthma this conception is as basal as it is beneficial. It sheds light on many allied conditions, such as laryngismus and familial oedema, which we were apt to consider had no such relationship, and for which we have been prone to neglect such preventive treatment as might have forestalled a fatal issue. Much more fruitful is this conception than that of asthma as a neurosis, which was that almost universally expressed at the asthma discussion of the 1911 meeting of the British Medical Association. If it be understood that a neurosis is not a disease of the nervous system, and if all neuroses are toxæmias, then asthma is a neurosis ; for there is no doubt that the asthmatic poison hits the nerves of the respiratory tract. Even if such a statement be correct, there is not only the theoretical criticism that the idea of toxæmia carries us a step further back than does that of neurosis, but there remains the strong practical objection that to regard a disease as a neurosis leads to symptomatic treatment, whereas the toxæmic conception ends in radical treatment. Hence the title of this book. That title has been deliberately chosen, both as to adjective and noun ; for though "radical treatment" does not always mean radical cure, it mostly does, and it certainly always means improvement, unless there are serious complications.

---

[1] Dr Burney Yeo, in his well-known "Manual of Medical Treatment," 1902 edition, made kindly reference to this paper, and to the toxæmic conception of asthma there advanced The idea of toxæmia, however, is not mentioned in the 1910 edition. This, and the absence of any reference to asthma as a toxæmia in the recent discussion on asthma at the recent meeting of the British Medical Association, prove how little hold this conception has had on the profession, a conception fundamental to a true interpretation of asthma and to its satisfactory treatment.

If proof were needed of the evil results of labelling asthma a neurosis, it could be found in the therapeutic vagaries of the last year alone. We have extreme emphasis put on the psychological factor in asthma (Saenger) ; we have the unfortunate asthmatic asked to come breakfastless to the specialist's consulting-room to have so-called "asthmogenic areas" inside his lung touched through a bronchoscope (Feudenthal); or he is advised to have his ribs or nasal nerves resected. As, in 200 patients, I have not seen one who, if there were no serious complication, no matter how long the duration of the asthma, could not be cured, as they count cure, I may be excused for emphasising a view and a plan which render such severe measures unnecessary. If we increase the list by adding serum injections, vaccines, and the host of new antispasmodics, of which the latest supports the name of tetrahydropapaveroline, we see in the multiplicity of remedies the proof of the therapeutic failure natural to symptomatic treatment.

While it was mainly certain features of the disease itself, forced on my attention fifteen years ago, that led me to the toxæmic conception of asthma, and while this view was steadily confirmed by the successful results of treatment conducted along that line, I owe a special debt to Bouchard's now almost forgotten book on Auto-intoxication. The records of many of my cases read almost like the clinical counterparts of some of his experiments.

The literature of asthma is a library, and I have not attempted to deal with it. Asthma, however, is probably one of the few diseases in regard to which the record of British medicine still takes precedence over that of other countries. Hyde Salter's book, written before most of us were born, must not be overlooked by anyone interested in the subject; he had probably a wider experience of asthma, and a better grip of the value of the dietetic treatment, than many twentieth-century authorities. That great clinician, recently passed from us, Samuel Gee, had a deeper insight into the real genealogy of asthma than most of his contemporaries. The experimental work of Williams, and of Brodie and Dixon, did much, along with that of foreign observers, to convince the profession of the fact of bronchial spasm; though it withdrew attention too much from facts in favour of co-existent, bronchial turgescence.

References to the literature throughout the book are given on p. 178.

For the convenience of the reader the main points of the book may be summarised in the following statements.

Asthma is primarily a toxæmia.

This toxæmia arises partly in the bowel, partly in the tissues; it arises partly by absorption of nitrogenous poisons resulting from intestinal putrefaction under microbic action; but mainly is due to an error in nitrogenous metabolism, the result of imperfect oxidation or enzyme action. In short, the poison arises from proteid food or proteid tissue.

The error in proteid metabolism is closely connected with excess of carbohydrate in the diet.

The oxidation of the excess of the simpler carbohydrate molecule seems to interfere with proper oxidation of the more complex proteid molecule. In other words, the excess of energy food interferes with the metabolism of the tissues and tissue-foods; the imperfectly metabolised products so resulting set up asthma.

The toxæmia, whether arising in bowel or tissues or both, tends to show itself first as catarrh, later as spasm, in the respiratory tract. This toxæmia shows itself in conditions, catarrhal and spasmodic, other than, but closely related to, asthma.

CHAPTER II

THE ACUTE ATTACK

THE futile question whether asthma is a disease or a symptom is not likely to disturb us after a consideration of the conditions that produce it and allied states. It has fallen between two stools, on one of which sits the general practitioner without the special knowledge and skill necessary to examine and treat nose, throat and bronchi, and on the other of which sits the specialist, with his attention concentrated on these regions, but neglecting the general condition of the patient, and the dietetic and hygienic errors that have led up to the asthmatic state. Far too much attention has been paid by both to the most striking feature of asthma, the asthmatic spasm; too little to the conditions that precede and cause the spasm, and to those by which Nature cures it.

Keeping in mind the conception of asthma as a toxæmia resulting from an error in metabolism and from intestinal putrefaction, we can see that the distinction usually made of secondary and primary asthma falls to the ground. We have instead to consider (1) a toxæmic condition more or less slowly evolved; (2) the asthmatic seizure. It will be more convenient to deal first with the seizure. With hay fever we have not directly to deal; no doubt it has, like other nasal conditions, an intimate relationship with asthma, and many patients have both diseases; but the majority of asthmatics have no hay fever; the majority of hay fever patients have no asthma. This point will be taken up later.

The term asthma is usually restricted to the seizure or spasm, though asthma involves much more than this. The term spasm is used in virtue of the suddenness and acuteness of the attack; the question whether spasm of involuntary muscle is actually present will be discussed later.

An attack of asthma is that form of dyspnœa which comes on more or less suddenly, usually in the small hours of the morning, without obvious cause, and which passes off more or less suddenly, without obvious lesion left—lungs, kidneys, heart, disease of any of which may cause dyspnœa, being normal. Like most dyspnœa this is usually afebrile. Generally, the typical attack is ushered in by a short irritating cough, or by sneezing, or by both, and is accompanied by loud wheezing audible to the patient's friends, as well as to himself. All his efforts seem concentrated on the business of breathing, the accessory respiratory muscles being called into play; there is prolonged wheezing expiration, short gasping inspiration, little or no pause at the end of expiration. The attack may last minutes, hours or days; commonly ends with the expectoration of a little tough mucus; the "mountain in labour" might itself well exclaim: "O ridicule mus!" Often there is only temporary relief from this expectoration.

As stated, sneezing and wheezing form a common picture in asthma; but both may be absent. Wheezing is rarely absent, but occasionally in incipient cases a patient will say he has no wheezing, only attacks of dyspnœa after meals. Such patients have often had in childhood what they call bronchitis. The taking of food in the case of an asthmatic often provokes an attack; one patient persistently says that if she could do without food she would have no asthma. Dust, odours, emanations and other nasal irritants also often provoke a seizure. When the attack comes on during the night it almost inevitably wakes the patient; but I have known a lad of 17 go to bed well, be seized during the night with wheezing severe enough to wake his parents, but not himself.

In marked attacks not only is the struggle for breath so severe as to make the patient sit or kneel in bed, but he may even get out of bed and stand gasping at an open window, or clutching at any support that will aid the accessory muscles of respiration. Many will not go to bed at all, but sit in a chair all night, dozing when they can. One victim used to stand at a mantelpiece with his elbows on it and his head in his hands; he has done this for twelve, twenty-four, thirty-six hours, till his legs were waterlogged. In such severe cases the appearance does not belie the acuteness of the distress; pupils and nostrils are dilated, face dusky yet ashy, the neck muscles taut and the hollows between them exaggerated, the chest distended, the pulse feeble and quickened, veins turgid, the extremities livid, sometimes almost black and sometimes showing petechiæ. Weakness, distress and gasping may be so great that the patient's friends may be summoned as to a deathbed; but he does not die; he starves—

necessarily—slowly recovers his appetite, usually overfeeds and thus works up for another attack. Very often the attack ends in "bilious vomiting."

Attacks vary in intensity and frequency. Sometimes they occur daily and are slight, coming on after waking or after a meal, lasting a few minutes or an hour, and only slightly incommoding the patient; or they may go on severely for days with slight remissions, or keep the patient in bed for weeks.

Prodromata, such as polyuria, tingling and other uncomfortable sensations in the skin, an irritating dry cough and constipation, are frequent.

Now consider the organs in detail; for only in this way shall we be able to understand Nature's efforts—which we are too apt to regard as the disease—to right the wrongs done her long before the paroxysm—these are the disease. In a general way it may be said that when the attack is impending the emunctories are acting badly, that as the attack goes on they act worse, and in a vicious circle—embarrassed breathing, constipation, oliguria, even anuria; this circle gets broken by the compulsory starvation, and then comes frank elimination — vomiting, diarrhœa, polyuria and free expectoration often winding up the attack. I do not say that all of this extreme picture is common, but parts of it are. Polyuria, for instance, may precede the attack, be followed by oliguria, and then recur.

The skin is often harsh and dry, and, especially before the seizure, may be full of those irritating sensations called formication; there may be pruritus or there may be a sudden urticarial eruption; thrice I have seen Raynaud's symptom, local asphyxia or ischæmia affecting the hands—all very interesting conditions in relation both to the toxic pathogeny of asthma, and to the physiology of the "spasm" in the lungs. Erythema may occur along with, and only along with, the spasm, or may alternate with it.[1] In colour the skin, as already stated, may be spotted with petechiæ, livid almost to blackness, or dappled, livid and pallid patches intermingling and showing up in exaggerated form the normal vascular network of Renaut. A branny desquamation may occur during convalescence, leaving the skin smooth and silky; women often have great loss of hair after an attack.

As illustrating some of those points and others to be presently mentioned, take the following case seen in 1897:—

> A woman of 34 had been troubled with bronchitis until 21; asthma began at 27, and during the following seven years weekly attacks kept her more or less constantly off work. Before an attack her motions became dark, her urine muddy; about 4 A.M. she would wake, feeling tightness in chest, tingling of skin and an indefinite irritability. She would pass pale, limpid urine in great quantity, and after an hour or two of these premonitory symptoms would have pronounced asthma. She would have to sit up in bed afraid to move because of increased distress; skin and nails became livid, showing petechiæ and turgid veins. There would be profuse sweating, and great palpitation, so that the patient sometimes swooned; much cough, but spit scanty, tough and sometimes blood-stained; great difficulty both of inspiration and of expiration, but chiefly the former. Usually bilious vomiting and diarrhœa occurred; menstrual discharge might appear. After 6 or 8 hours of the polyuria the urine again became scanty and loaded with urates. During an attack

---

[1] See a case quoted by Batty Shaw (*Proc. Roy. Soc. Med.*, vol. v., 1911, page 23).

the skin was harsh with profuse branny desquamation, but after it became fine and silky; a similar change was noted in the hair. An attack would last 36 or 48 hours, and leave her exhausted. Slight emphysema, no albuminuria; polypi and hypertrophied turbinals in the nose, and attacks of sneezing were other points of note. After nasal and other treatment, the patient has remained cured for twelve years.

RESPIRATORY TRACT.—The NOSE is rarely normal, there is commonly some nasal obstruction; apart from polypi or septal deviations, the turbinals are often turgid, blocking the air-path; they and the septal tubercles opposite the fore end of the middle turbinals are often very irritable, so that a touch with a cotton-tipped probe causes coughing or sneezing. In a few cases nothing obviously abnormal can be found in the nose; the turbinals may not be turgid.

Apart from congestion of the mucous membrane, which is not always present, the most striking thing about the larynx, as I pointed out in 1900, is that in bad asthma the vocal cords are held wide apart, moving little or none with respiration. The trachea can then be seen to be more or less congested, according to the severity of the attack and the amount of coughing. This congestion has recently been described by several writers, who have used the bronchoscope, as extending as far down the bronchi as they could see; but this point, as well as the occurrence of oedema here and in the larynx, will be referred to later (Chapter VI.).

CHEST.—At the height of an attack the chest looks and is distended; percussion yields a resonant note rising in the neck as high as the level of the cricoid and even of the thyroid cartilage, obliterating the heart dullness, and pushing down as well as lessening the liver dullness, till its upper border in the nipple line is only an inch or two above the costal margin. This distended chest, notwithstanding the concentrated muscular effort at respiration, is moving but little.

Most writers emphasise the expiratory difficulty in asthma ; but most patients, while admitting such a difficulty, emphasise the difficulty of inspiration. (Of 43 patients questioned on this point, 25 said inspiration was the more difficult, 12 expiration, and 6 said both are difficult.) As one would expect, inspiration into an already well-filled chest is short and gasping ; then follows a vastly prolonged wheezing expiration—that is, the normal ratio of the two efforts is reversed as to length, expiration eating up the pause that should precede inspiration. How the various muscles are acting in this abnormal process is a matter of discussion, and probably varies in different cases, and with the severity of the attack ; but one thing is certain—that whereas normally expiration is largely a matter of elastic recoil, in asthma it is mainly one of muscular effort.

The diaphragm acts powerfully ; some hold that it is in spasm in whole or in half, in the latter case accompanying or causing unilateral asthma. In one case where the difficulty was mainly inspiratory and where, though there was much wheezing, the expiratory difficulty was not nearly so great, the expansion of the chest at nipple level by inspiration was only ⅜ inch ; at xiphoid level the expansion was actually ¾ inch greater at the end of expiration than at the end of inspiration—that is, the lower ribs were sucked in during inspiration by the tense diaphragm. The figures on the annexed diagram will show that in this lad of 17, who, owing to a lifetime's asthma, had pigeon-breast and some emphysema, there was still fair respiratory capacity, but that during asthma the chest was kept distended nearly to its full capacity.

On auscultating such a chest, one finds a much diminished, scarcely audible inspiratory murmur; it has no volume; on expiration there is a chorus of whistling, cooing, " kitten " rales over the whole chest, or more at one than another part of the same lung; often appearing and disappearing in whimsical fashion; often more in one lung than in the other, and in several such cases I have noted greater obstruction in the ipsolateral nostril. That obstruction in the larynx and trachea affects the rate and mode of respiration is well known, but I am not aware that the connection here indicated between unilateral nasal obstruction and ipsolaterality of asthmatic signs has been mentioned. At first I thought this was mere coincidence, but now I have seen it so frequently (see cases narrated in Chapter X., on Prognosis) that I am inclined to regard the nexus as intimate, a nervous reflex. Nearly always it will be found that when, in asthma, one lung is moving less than the other, the corresponding nostril is the more obstructed.

There is a general opinion that patches of collapsed lung are common, so that I hesitate to confess to missing them. One would expect them, and certainly I have seen them in a few cases, but cases where such collapse persists are, much oftener than

CHEST EXPANSION

in an asthmatic lad of 17; asthma since infancy.

Asthma-free		Asthma	
Expir.	Inspir.	Expir.	Inspir.
33″	36″	35″	35⅜″
29¾″	33⅝″	32″	31¼″

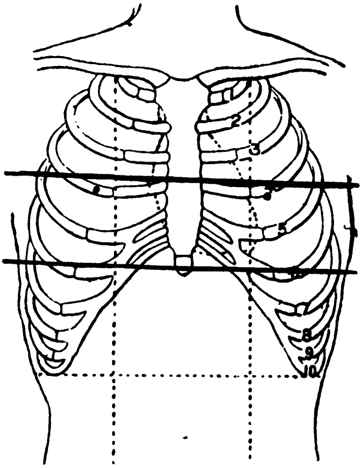

FIG. 1

This diagram shows:

(1) That the ordinary respiratory capacity is good, and that therefore, notwithstanding frequent recurrence of severe asthma during a lifetime, emphysema is not great.

(2) That during the paroxysm the chest is kept distended nearly to its full capacity.

(3) That, in this case, inspiration during the paroxysm is largely dependent on the diaphragm, for at xiphoid level the circumference is ¾″ less at the end of inspiration than at the end of expiration.

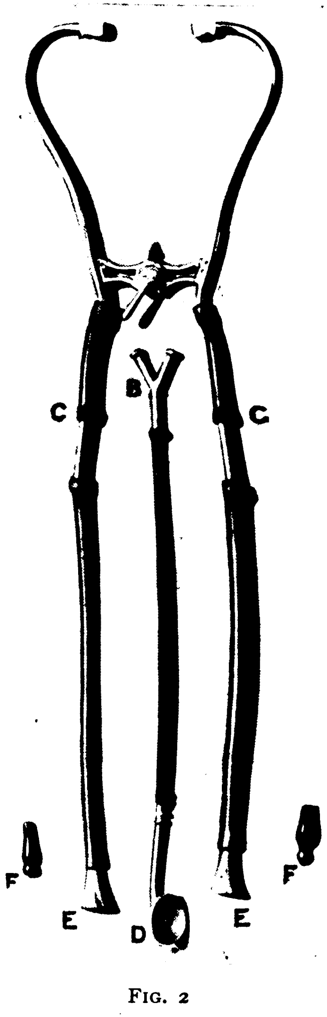

FIG. 2

ACE. Differential Stethoscope.

FF. Aural tips to be substituted for chest-pieces EE when the instrument is to be used as a double otoscope.

B. Y-piece to be inserted at CC when instrument is to be used as ordinary binaural stethoscope.

D. Dr Wm. Allen's chest-piece.

is suspected, cases of undiagnosed phthisis (see p. 118 *et seq.*).

Perhaps I may be pardoned for mentioning the value of the differential stethoscope in examining obscure lung conditions. The great advantage of such an instrument is that one compares two sensations present in opposite ears at one time, instead of one sensation with the memory of another; it is of especial value in comparing the volumes of the respiratory murmur. The pattern illustrated was made for me by Downs Bros. it has the advantage for the aurist that for the chest-pieces aural tips can readily be substituted, to form a double otoscope that sticks to both examiner and patient. By removing the differential tubes and substituting a Y-piece an ordinary binaural stethoscope is got, in using which I find my friend, Dr Wm. Allen's, chest-piece very serviceable.

When the attack stops, as it may sometimes be made to do[1] in a few minutes, by the application of cocain and adrenalin inside the nose or to the larynx, or by the hypodermic injection of adrenalin, the abnormal lung signs pass with the symptoms; the distension and the rhonchi go, and, if there is no emphysema, the full volume of the respiratory murmur, the full area of heart and liver dullnesses, return. Often, however, and especially in chronic cases, moist or cooing rales can be heard between attacks.

The asthmatic sputum varies. Often there is none till the end of the attack; then it is in the typical form of small, tough pellets expelled by laborious coughing. The attack may then cease, or it may go on till a more free and profuse expectoration occurs; in severe cases it is not uncommonly streaked with blood. The asthmatic sputum, then, is mainly of two kinds, (1) scanty strings or pellets; (2) a copious, fairly easily expectorated, gelatinous-looking material somewhat like boiled sago, with little admixed air. It may pass from the former to the latter type as the attack progresses; more commonly it remains of the one type throughout. The sputum does not readily decompose, and is said to be wonderfully free from microbes; but this is not always so, as I have occasionally found it teeming with them. It has a threefold characteristic content—Curschmann's spirals, Charcot-Leyden crystals, crowds of eosinophile cells.

---

[1] See thesis in Glasgow Hospital Report, 1900, p. 155.

It should first be examined with the naked eye on a black background when the spirals can often be seen; a small piece should then be picked out and spread with forceps in a thin layer on a slide, and examined with a low power without a cover-glass; this will show the beautiful spirals when present. The high power is necessary for the crystals and will also show the very granular eosinophiles, though they are best stained, and examined with the oil immersion. These are nearly always found; the crystals and spirals are often hunted for in vain.

Berkart gives a good description, with excellent illustrations, of asthmatic sputum; he also figures sputum-casts of the bronchi. Sahli's description is also good. The following is the best I have seen, and is taken, with his kind permission, from Emerson's "Clinical Diagnosis," pp. 67-71 (published by Lippincott):—

> "During the paroxysm itself there is often no sputum; in other cases it is scanty, clear, consisting of thick glairy mucous balls, the so-called 'perles of Læennec,' which swim in a thin, clear, frothy mucus. In other cases it is less

characteristic, of a greenish-yellow tenacious mucus, and described by the patient as 'rubber-like.' These perles are pellets of a semi-transparent mucus, of a pale grey colour like boiled tapioca. In them are mucous moulds of the smaller tubes, and some on unravelling are Curschmann's spirals. Early the sputum contains a few eosinophilic cells and many alveolar epithelial cells with myelin degeneration. The moulds are small cylindrical or sausage-shaped masses consisting of thick threads, or plugs, which may be from 1 to 1·5 cm. long. Some branch, some are narrow or straight, while others are spiral. These have the same significance as the Curschmann spirals. The amount of sputum at this stage may be from very little to 50 cc. In the sputum also may be found alveolar cells with myelin degeneration and very few leucocytes.

"In 27 per cent. of our cases, there were in some of the paroxysms slight hæmorrhages. As the attack 'breaks,' however, the sputum becomes thinner, more liquid, frothy, and much more abundant, even 200 cc. in twenty-four hours. It is then a clear, viscid fluid in which float mucopurulent masses. In one of our cases was present a true bronchial cast about one and three-quarters inches long, consisting of mucus and eosinophile cells.

"During the next two or three days the character of the sputum changes much. It is often small in amount and mucopurulent, with, however, some clear frothy fluid. As a rule, now, no Curschmann's spirals are found, although in one case, in which they had been present in good numbers, they were more beautiful than before. Fibrin casts of the bronchi are sometimes present, occurring with the spirals, which they may exceed in numbers. At the tip of some of the branches the cast may be continuous with the central fibre of a typical Curschmann spiral. Along with the spirals occur large numbers of eosinophile leucocytes. In some cases, but rarely, Mastzellen. Where the eosinophile cells are increased it is common also to find the Charcot-Leyden crystals. Calcium oxalate crystals have also been found. As a rule the sputum ceases as soon as the attack is well over. In some cases, however, it is almost continuous, even 100 cc. per day, but may have sputum-free intervals.

"CURSCHMANN'S SPIRALS.—These beautiful structures occur at some time in perhaps every case of true bronchial asthma. This, however, does not mean that they will be found in every paroxysm of this disease in which they are sought. While they may be present during the paroxysm, they are found particularly just at the end, as the sputum increases, and, as a rule, are absent after it has become mucopurulent. They may be present in large numbers.

" In general, two forms may be described. The first is a spirally twisted strand of mucus enclosing leucocytes, eosinophiles, and Charcot-Leyden crystals. The second and more beautiful form consists of a tight skein of mucus wound around a central fibre. This may be from 1 to 2 cm. or more long, and 1 mm. broad. It may be branched. These spirals have two parts; the 'mantle' which is the mucus surrounding the 'central fibre.' The mantle contains, besides eosinophiles, many pigmented epithelial cells, some ciliated cells, and Charcot-Leyden crystals. The arrangement of these cells, not mixed, but in lines and groups, is interesting. The central fibre, which probably consists of transformed mucus, is very refractive. It is a spirally twisted strand, homogeneous, with a sharp contour or saw-edged. While the calibre varies, it is quite constant throughout one spiral. Central fibres are subdivided into the small size, from 0·5 to 1 micron in diameter, the medium-sized, 3 microns, and the thickest, even 18 microns in diameter. In sputum which was hardened *en masse* and cut in sections, they were found by Ruge to be solid without evidence of the lumen which others have claimed. These fibres are sometimes well developed, sometimes present only as a trace; they may be absent. They end sometimes as a thread, while in other spirals they give off a multitude of lateral threads. The finer are often branches of larger threads, or the smaller may unite to form a larger. Some of the larger types give off fine threads radially to the mantle in all directions. In structure some are lamellated, while others seem to be a bundle of parallel threads, spirally twisted. These central fibres may be differentiated by staining, and hence are not optical phenomena presented by the most compressed part of the spiral, as some claim. They occur alone sometimes, and have the same significance as perfect spirals. When alone they are spirally twisted. In some cases occur perfect spirals; in others, many free central fibres: again others, free central fibres, and some with very imperfect mantles.

"As regards the origin of the spirals, the central fibres are certainly not casts of the smaller bronchi, since they are often only about one-tenth as big. Schmidt claimed that for their formation the epithelium must be well preserved, that they consisted of mucus secreted in the smaller bronchi, the centre representing the most twisted part, that is, of the greatest relative compactness; and for their formation a tough mucus was the important thing. Hoffmann claimed that the smaller bronchi are themselves spirals, which become straightened out as the lung expands, and that the tough mucus forced through these spirals can assume a spiral shape. Others claim that the cilia motion in the bronchi must be in spiral waves; others that the spiral is formed from a straight band of mucus which in passing the bifurcation of two bronchi is whipped into a spiral by the cilia of the other bronchus, the direction of whose cilia motion will be tangential to the axis of this thread. Gerlach gave three conditions necessary for their production—a small amount of very viscid sputum, very forcible respiratory movements, and clear bronchi. These three conditions are best given in asthma. He claimed that the mantle and central fibre are formed in the same place, but that the latter is formed later, and is merely an optical expression for that part of the mucous mass which has been twisted the most. We would say, however, from studying the spirals we have seen, that while the central fibre is itself spirally twisted, there are many fewer revolutions per unit of length than in the mantle.

"In cases which we recently had a chance to study the spirals were beautiful, about 2·5 cm. long and 1 mm. broad, and with a central thread so refractive that it could be definitely seen by the naked eye. While fresh it is interesting that this thread could not be studied with the higher powers because of its high refractivity, and seemed to be merely an optical phenomenon. At certain points, however, where the mantle was thin, and particularly after the spirals were allowed to dry somewhat, it could be easily studied, and was found in some cases to be a bundle of twisted fibres. The mantle was very tightly twisted, and on cross-section at certain points it could be seen that it consisted of spirally wound sheets of mucus reaching from the central thread to the periphery. It was filled with various cells; among these, squamous epithelial cells, very many alveolar cells, many containing coal pigment and others modified hæmoglobin. In all fields were a great number of eosinophiles, in many, cylindrical cells which appeared ciliated, although the cilia were not as distinct as might have been desired, and among them goblet-cells. It is interesting that in the structure of the spiral these cells were not mingled, but each variety occurred in groups or lines and large numbers in each group. The Charcot-Leyden crystals occur singly or in clumps, some quite large. One was projecting from an eosinophile cell and surrounded by its detritus. In some fields full of leucocytes search was made in vain for one which was not eosinophile. In one specimen was found a strip of mucosa of cylindrical epithelium. Other spirals had no core, and some spirals consisted merely of a very large refractile central fibre. If the spirals be allowed to dry the central thread is much more distinct. In some cases they are a bundle of longitudinal fibres slightly twisted.

"CHARCOT-LEYDEN CRYSTALS.—These Charcot-Leyden crystals, present wherever the eosinophile cells are increased, are very common in asthmatic sputum. Their number may greatly increase as the sputum stands. These crystals occur in groups, forming specks of a greenish-yellow colour, which masses may be seen even with the naked eye. They may give to the spiral a yellowish-green colour microscopically when present in large clumps along the spiral. It is important to bear in mind that their size varies so that their presence can be excluded only when a search has been made with the oil-immersion lens. They increase in size and number as the attack lasts. (In cases in which none were found at first they will appear in the sputum if it be kept in a warm chamber) Concerning their composition all that can be said is that there exists in the sputum a substance which after expectoration is crystallisable in this form. The same is true of tyrosin, and the French seem eager to identify the two. They practically always occur in asthma, but careful search is necessary, and in case they are not found it is well to let the sputum stand.

"The ALVEOLAR EPITHELIAL CELLS laden with golden-yellow pigment may occur in large numbers and fill a considerable part of the mantle of some of the spirals. They occur chiefly in clumps packed together, and in other parts of the specimen none will be found. It is interesting to see what large masses of these cells will occur in certain parts of the spirals. Their origin, V. Noorden says, is clear; that in asthma we have frequently small traces of blood in the sputum, and that this is the source of the pigment of these phagocytes. These cells are similar to the Herzfehlerzellen seen in chronic passive congestion.

"There is a well-marked group of cases which may present a transitional stage between asthma and fibrinous bronchitis. The sputum contains spirals, Charcot-Leyden crystals, eosinophile cells, all the constituents found in asthma, but also casts of the smaller bronchi, which, however, do not branch much and which may at one end tail off into the central fibre of a true spiral. In one case of Dr Osler's these casts were 1 to 3 cm. long."

CIRCULATION.—The pulse is usually slightly quickened; it is often 90 to 110, rarely 120 or even 130; sometimes it intermits. There seems to be a common notion that the asthmatic pulse is one of high tension; but this is an error of the books.

For years before the sphygmomanometer came into common use I had looked for high-pressure in asthma, and could not satisfy myself of its presence; and on the whole this impression has been verified by the use of the instrument. Woley gives a table compiled from the examination of 1000 healthy persons by five physicians; he divides them into four age periods. This table is here given, together with my observations on asthmatics taken with the Riva-Rocci instrument. In the first age-period there are three patients; none had pressure greater than the average high pressure, and one during asthma had a pressure lower than the average low pressure.[1]

---

[1] "Average high pressure" was obtained by averaging the highest 15 per cent. of records; similarly for "average low."

TABLE OF BLOOD PRESSURE IN ASTHMATICS

Woley's Table of Arterial Pressure as found in 1000 Healthy Persons Average high pressure = average of highest 15% ,, low ,, = ,, lowest 15% of records in each age-period.	*Arterial Pressure as found in Asthmatics* The different cases are indicated by the numbers in brackets. Where two figures for pressure are given against one case, it means that these pressures were taken at different times. A = Asthmatic paroxysm.
mm. Average pressure for males at all ages, 127·5 ,, ,, females ,, 120	
Average pressure for persons aged 15 to 30, 122 ,, high pressure ,, ,, ,, 141 ,, low ,, ,, ,, ,, 103	(1) 115; (2) 95A, 98A; (3) 135 just after A.
Average pressure for persons aged 30 to 40, 127 ,, high pressure ,, ,, ,, 143 ,, low ,, ,, ,, ,, 107	(4) 160 before treatment and during slight A, 125-135 after treatment; (5) 105; (6) 120-140 (albuminuria frequent); (7) 120; (8) 120 raised to 145 by exertion; 95 after a month A free; (9) 130 A; (10) 130; (11) 110, but 95, 105, 115 during A; (12) 105, but 115 A.
Average pressure for persons aged 40 to 50, 130 ,, high pressure ,, ,, ,, 146 ,, low ,, ,, ,, ,, 113	(13) 120; (14) 125-130; (15) 110, but 95 A; (16) 95; (17) 105, but 112 A; (18) 130, but 102 A supine, 120 A sitting.
Average pressure for persons aged 50 to 60, 132 ,, high pressure ,, ,, ,, 149 ,, low ,, ,, ,, ,, 115	(19) 120; (20) 120-140; (21) 145; (22) 115-135; (23) 140 A supine, 150 A sitting; (24) 140, but 125 after fortnight's treatment; (25) 190 (10 p.m. after 24 hours' work), 165 a year later after 2 weeks' rest from work owing to asthma.
Average pressure for persons aged 60 to 70	(26) 130-165; (27) 135; (28) 160.

Nine patients during the second period, age 30 to 40, show but one with excessive pressure, and he was an alcoholic, whose pressure of 160 at the beginning of treatment and during an attack was reduced after treatment to 125, together with improvement of his asthma. A second, whose pressure of 140 almost touches the normal limit, had frequent albuminuria. In the third period, 40 to 50, none out of six patients exceeds the limit; two cases had abnormally low pressures. In the age period 50 to 60, of seven patients one had rather a low pressure (120); one had the excessive figure of 190. This was a baker, aged 52, examined at 10 P.M. after he had been twenty-four hours on foot; he had no albuminuria and no asthma. Examined a year later, after severe asthma and prolonged rest, he gave a pressure of 165. Of the three senile patients one was a man of 70 with constant slight albuminuria (sp. gr. 1012), and bad asthma, erroneously thought to be renal. His pressure of 165 came down with treatment to 135; his asthma at the same time practically disappeared. The second, aged 62, had a pressure of 135, soft arteries, and yet for years he had had asthma every night; he is now well. The third is a man of 71 with slight asthma most mornings; pressure 160, which is at the limit of normal; but he has the disadvantage, doubly serious for an asthmatic, of having only one leg, and thus open-air exercise, which is so important both for keeping down asthma and the blood pressure, is hindered.

Thus, of 28 patients only 2, and these in special circumstances, had pressure exceeding the limit normal for the age. The fact that blood pressure is not materially raised in asthma is of some interest in relation to the fact, as shown by Walker Hall, that the blood pressure is not altered by purin bodies, and as we shall see there is in asthma increased excretion of uric acid (trioxypurin) and probably of other purins.

The second point that is evident from a study of this table is that the treatment, which rids the asthmatic of his toxæmia and of his paroxysms, brings down his blood pressure ; and yet the treatment which dispels the paroxysm often momentarily raises the pressure. For, a third point shown by the table is that the pressure during the spasm is often lower than the pressure between spasms, though this is not always so (*e.g.* 110 between spasms but 105 and 95 during spasm ; 110 between spasms but 95 during spasms ; 130 between spasms but 102 during spasm). Now the hypodermic injection of adrenalin almost instantly relieves the spasm, but it raises the blood pressure.

A lad of 17 had a bad attack of asthma, pulse 84, pressure 98 ; a similar pressure (95) in a previous attack verified this low figure ; injection of adrenalin raised the pressure in ten minutes to 115, but the asthma was less ; twenty-five minutes after this the asthma was gone, and the pressure was still 108, pulse 106. Surely no better proof than this could be given that the paroxysm itself does not raise the blood pressure. We have also in these facts an explanation of the comparative uselessness of vaso-dilating drugs such as amyl nitrite and nitroglycerine, which I have never found of much help in relieving asthma.

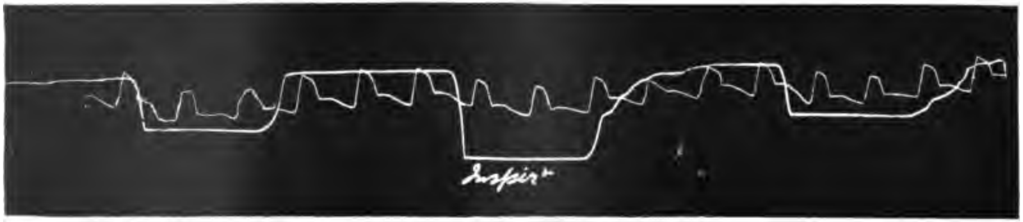

Fig. 3

TAKEN DURING AN ATTACK OF ASTHMA

The fall in the pulse-tracing induced by the violent inspiratory effort corresponds with a concomitant fall in the blood-pressure

Another point, typical of bad asthma, was noted in this case as in others; the lowering of the blood pressure toward the end of inspiration, its rise toward the end of expiration; this difference may be 10 to 20 mm. In other words, it may require 15 mm. more pressure to obliterate the pulse at the end of expiration than at the end of inspiration. Commonly the difference is about 15 mm., but I have seen as much as 40 mm. difference between expiratory and inspiratory pressures; during inspiration the pressure was 80 to 90, during expiration 120 to 130. This is illustrated by the regular rise and fall of the pulse tracing here given and taken during the paroxysm, and has also been figured by Mackenzie. Five minutes after injection of adrenalin with immense relief to the asthma, the pressure altered to 80 at end of inspiration, 110 at end of expiration, the pulse remaining about the same, 120. In regard to this difference Mackenzie[1] says: "It is as if the laboured inspiratory effort had reduced the arterial pressure, either by sucking more venous blood into the chest, and thus expediting the flow from the arteries, or by embarrassing the outflow from the chest." The former seems the more likely. This lowering of the arterial pressure during the spasm is what, on second thoughts, we should expect; for we have then increased venosity of the blood and impeded pulmonary circulation, as shown by the distended veins, petechiæ, and occasional hæmoptysis; the respiratory difficulty, at the same time as it increases the labour of the right ventricle, impedes the nutrition of the left, and it is no wonder that a prolonged severe attack may sometimes cause the patient to swoon, as in the case of the lady mentioned on p. 11; especially when we also remember that such attacks compel starvation. That the right ventricle is acutely distended we can hardly doubt, and part of the speedy relief given by adrenalin hypodermically probably results from its direct action on the distressed ventricle itself through which it has to pass. And yet, I must make two remarks. First: it is often stated that there is accentuation of the second pulmonic sound during the spasm, and we should expect it, but over and over again have I listened for it and only once have I found anything approaching it. Of course, the noisy respiration in the worst cases drowns the cardiac sounds, but this is by no means the whole story, though at present I am not prepared with further comment. The second remark relates to the action of adrenalin. Why does it stop the spasm? I have to suggest that its first action is on the heart, and then on the bronchial vessels. Given subcutaneously or intravenously it goes straight to the distressed right ventricle, and will help it to contract. We know that it powerfully stimulates the heart to do so. Further, as I have already stated, the application of adrenalin (usually combined with cocain) to the nasal mucous membrane, or to the larynx, not only promptly reduces the turgescence and congestion there, opening the nasal passages wide and blanching the injected tracheal mucosa, but it also, in many cases at least, stops the asthmatic spasm. Combined with cocain it may do so reflexly by inhibiting impulses from the nose to the bronchial constrictors. That this is part of the explanation seems likely from the fact that the combined drugs, intranasally applied, act best when there is marked turbinal turgescence. Part of the spasm-allaying effect may be due to absorption of the drugs from the nasal mucous membrane or larynx or trachea. But while adrenalin applied to the larynx acts fairly energetically in allaying asthma, applied to the nose it acts much less energetically than when given hypodermically. However it is given, after arriving at the right ventricle the adrenalin will pass direct to the lungs and there, probably somewhat indirectly, it will have the same effect on the congestion of the bronchi and bronchioles as on nose and larynx. In this way and by its action on the heart it will help to relieve the dyspnœa; but Melland[1] makes a further interesting suggestion. Adrenalin acts as a stimulant to the sympathetic. He suggests, and gives supporting evidence, that at the same time it tends to inhibit or relax all involuntary muscles supplied by the cranial and sacral outflow of nerves. Now the constrictor muscles of the bronchi belong to this group, and assuming that spasm of these in part accounts for the asthmatic spasm, they would be relaxed by the adrenalin. Whereas, the constrictor fibre of the bronchial arteries which come off the systemic system, and are, like other systemic vessels, under sympathetic control, will be stimulated to contract, and so the congestion is reduced.

---

[1] Mackenzie, "The Study of the Pulse," p. 170.

The BLOOD during the acute attack is rich in eosinophiles, as we should expect from the way in which they crowd the sputum. Emerson[1] gives the figure of even 53 per cent.; of eight of his cases six had above 5 per cent., maximum 20 per cent. Like him I have found the red count high: 5,940,000 in one case, leucocytes 13,400.

---

[1] Melland, *Lancet*, 1910, vol. i., p. 1407.

NERVOUS SYSTEM.—Asthma would not have been so generally called a neurosis but for the prominent symptoms which seem to own a nervous origin, and I do not deny that the toxæmia does affect the nervous system. Apart from the question of bronchial spasm, which will be discussed later, there are other interesting nervous symptoms relating to the acute attack. The prodromata, when present, are mainly nervous. Perhaps the most interesting from the toxæmic point of view are the drowsiness and yawning of which so many patients complain, and by which they can foretell an attack. This, as preceding spasm, is distinctly significant if we accept Bouchard's experiments which seem to demonstrate that day urines, especially after a day of exercise, contain toxins which tend to induce sleep, while night urines develop convulsive toxins (see also p. 45). The passing of a large quantity of clear, pale urine, which sometimes precedes the attack, may be reckoned as in part a nervous symptom; as must also some of the cases of diarrhœa. The knee-jerks are usually lively, even exaggerated. Irritability, tingling of the skin, formication are precursors that have already been mentioned.

DIGESTIVE SYSTEM.—The anorexia characteristic of the attack itself is sometimes preceded by a voracious appetite which the patient would be wise not to gratify. If he does feed during the paroxysm he often vomits, and vomiting may end it ; indeed, Hyde Salter regularly used emetics for this purpose. Diarrhœa, also, may be terminal. A most interesting parallel has been drawn by Hertz between spasmodic asthma and spasmodic mucous colitis, but this comes more appropriately later ; the two sometimes concur. Flatulence occurs in most cases, and some patients say they " feel like to burst." The stools are often dark and particularly offensive, a fact directly connected with the toxæmia.

---

[1] Emerson, "Clinical Diagnosis," p. 633.

The URINARY changes are interesting as suggestive of toxæmia ; but as their due significance can be best appreciated after a study of the chronic asthmatic, they are merely summarised here to complete the picture. They are (1) reduced quantity, initial polyuria being only a striking exception ; (2) uric acid excess ; (3) increase of indigogens and of the ratio of the ethereal to the fixed sulphates ; (4) occasional albuminuria.

CHAPTER III

THE CHRONIC ASTHMATIC

THE acute attack just described varies in severity and in its tendency to recur. For instance, in a lad of 20 the one symptom was dyspnœa after meals; no wheezing, no coughing, some nasal catarrh. He has a twisted septum and is a mouth-breather; dietetic treatment sufficed to dispel the attacks. Twice I have seen patients who have had only one attack. An old gentleman had a slight hemiplegia and was carefully coddled and much fed up in consequence. From being somewhat spare he quickly developed into a stout, red-faced, jolly-looking old man, till one night he had a typical attack of asthma. He never had another; his diet was reduced to fit the exercise of which he has remained capable for the last five years. Similarly, fifteen years ago, a lady of 35, who suffered much from a bleeding fibroid and from chronic urticaria worse at bedtime, had a single attack of asthma. A boy, now 19, had attacks of asthma during several mornings of one week when he was 14; he has had no more since he altered his diet. But these were cases caught at the outset; usually asthma has become chronic, and has been treated as bronchitis before one sees it.

Of the chronic asthmatic there are two types, the fat and the lean. The latter is the more common and much the more typical. For while in certain subjects overfeeding does develop fat and asthma, the tendency even in them as the disease becomes more chronic—*i.e.* as the toxæmia increases—is to grow more like their leaner fellow-sufferers. In these we find the features of the acute attack become more or less permanent. The starvation of the paroxysm is translated by leanness; the lung distension into emphysema; the attitude of straining dyspnœa by rounded shoulders and a more rigid, expanded chest.

Most striking of all is the dusky, sallow skin with chloasma round the eyes, sure token of toxæmia. There is no mistaking this asthmatic cachexia, and the first sign of improvement resulting from correct treatment is the clearing up of the skin; it looks as if it had been washed from the inside—as it has been. There is also what is called chronic bronchitis; but except it, of all these signs of chronic asthma the commonest are those of the skin. It takes prolonged, repeated and severe paroxysms to develop the others.

Nothing could well be more astonishing than how little emphysema one finds after years of asthma, provided the attacks are not very prolonged; the heart suffers equally little. While the toxæmia unless treated—as it too seldom is—is more or less constant, acting on skin and bronchial mucous membrane as well as on the tissues generally, producing the cachexia and bronchitis, the stress of the dyspnœa, which is the main factor in producing the other thoracic changes, is intermittent.

To illustrate some of these statements and others which will presently have to be made, and especially as some of them are not in harmony with the text-books, it is worth while to give in some detail the following case, although it has already been referred to :—

> " A man of 58, compelled to very irregular hours for work, sleep and meals, came to me three years ago on account of asthma starting from influenza twenty-eight years previous. The attacks were severe, mostly nocturnal and at week-ends—Sunday, Monday and Tuesday ; but when I called attention to this fact, he remarked, ' Well, last Sunday I was *working hard* all day, and although it was foggy and bad weather for me, I was as fit as a fiddle.' These attacks were usually accompanied by ' biliousness,' extremely bitter taste in the mouth, discharge of glairy mucus from the nose ; flatulence was extremely troublesome. For a year before coming to me he had asthma practically every night ; had not been a whole night in bed ; sometimes had to stand gasping and leaning on a mantelpiece the whole night, and even the whole day as well, till his legs were waterlogged. There were some polypi in his nose ; others had been removed and his septum resected by another surgeon, without much benefit beyond greater freedom in breathing. He had lost 22 lbs. in weight in two years and now was a lean, sallow, round-shouldered man. His chest was somewhat barrel-shaped, but projected posteriorly in its upper part, anteriorly in its lower. This formation was probably associated with his attitude during the forced respiration of the spasms. The respiratory murmur seemed somewhat diminished and was accompanied by cooing rales ; heart and liver dullnesses were not, however, much reduced ; heart sounds pure, arteries soft, pressure 120. These are somewhat striking facts after nearly thirty years of asthma, and such asthma. His nose was attended to, but the treatment was mainly directed to his digestive disorders. Within a few weeks he began to improve, and since that he has never been a night out of bed on account of asthma. I showed him to the Southern Medical Society of Glasgow as a typical asthmatic, thinking that in addition to the formation of his chest, I would be able to demonstrate the asthmatic cachexia ; but his skin was as clear as a child's and nearly as rosy ; he had put on a stone in weight. He remains very well, notwithstanding his previous twenty-eight years of asthma."

Apart from the chloasma and the chronic urticaria, already mentioned, there are certain SKIN conditions associated with asthma, of particular interest from the toxæmic point of view.

ECZEMA is by far the commonest. It is most apt to occur in children along with the bronchitis, which is really the form asthma commonly takes at first with them; but if the asthma does not clear up it also will be found to dog them beyond adolescence to middle age. The eczema depends on the same dietetic and metabolic errors as asthma—carbohydrate excess, helped by intestinal toxæmia—but the toxæmia of eczema is less profound than that of asthma; for not only does the eczema develop before the asthma, but although treatment on similar lines is applicable to both, the eczema tends to disappear first. That eczema is based on a toxæmia is tacitly admitted by everyone who finds it impossible to treat a chronic case without attention to what is called the general condition, and this albeit no part so offers itself for local treatment as the skin.

"A boy of 26 months was sent to me by Dr Alex. Morton. He had cured him of bad generalised eczema; but asthma occurred almost every night in spite of the fact that the dietetic regimen laid down by Dr Morton was what I myself would have set for the asthma. This boy was the subject of hay fever and ichthyosis; his urine showed persistent deposit of uric acid and increased indigogens. His maternal aunt had eczema in childhood, and now has asthma; his paternal aunt has eczema and asthma; there is a history of gout and uric acid on the mother's side. Treatment freed him from asthma for a year. He then went to stay with his grandmother who coddled him, gave him the forbidden thing, sweets and cakes, and soon brought back both eczema and

> asthma. Not only so, but interesting etiologically is the fact that adenoids and chronic rhinitis have developed, for which treatment has been declined ; but although this injures the prognosis, the asthma has never been so bad as at first. A boy, whose father was long asthmatic but has remained well for many years, was much troubled during the first two years of life with eczema, the result largely of overfeeding. He is now five, and during the last two years he has developed 'bronchitis,' which is now taking the more typical asthmatic form."

The association, bad feeding, eczema, bronchitis, asthma, is too frequent and too plain for anyone to doubt that a metabolic error, or at least a toxic condition, is in play.

Ichthyosis, as just indicated, is another skin condition sometimes associated with asthma. Being congenital it also bespeaks a metabolic defect.

Psoriasis is stated to be often associated with asthma, but I have never seen the combination ; nor has my friend, Dr Alex. Morton, and if the association is important this is odd, for psoriasis is common in Scotland, and Dr Morton, as dermatologist to Glasgow Royal Infirmary, is likely to see as many cases of psoriasis as any man in these islands. There is another reason for doubting whether there is a real nexus between the diseases. While it is becoming more and more common to assign a toxic basis for psoriasis, it is restriction mainly in carbohydrate excess that improves asthma and eczema, whereas in psoriasis it is the nitrogenous intake that is said most to need restriction.

Dermatitis Herpetiformis is another inveterate toxæmic condition that I have seen to have a real connection with chronic asthma.

Another striking fact is that most of these skin conditions when occurring apart from asthma resemble it in this, that they are characterised by that common accompaniment of toxæmia—eosinophilia.

The bronchitis which, like the skin affections of asthma, is a direct expression of the metabolic error, will be more conveniently discussed in the chapter on atypical asthma.

We have now to consider those CHANGES IN THE CHEST resulting mainly from the dyspnœa.

After years of asthma the signs of emphysema develop—diminished respiratory murmur, overlapping and diminution or abolition of cardiac dullness by the altered lungs; the liver dullness is both depressed and diminished. The thoracic cage becomes distended, causing the rounded, somewhat stooping shoulders of the asthmatic. If the paroxysms have been bad in childhood, the greater distension of the right lung is apt to cause the lower right half of the chest to project more than the left; there may even at the same time be a constriction of the lower left ribs as if drawn in by the diaphragm. A kind of pigeon breast may also show. But generally it may be said that the upper part of the chest overhangs the lower. Berkart attributes asthma largely to rickets; he says also that all asthmatics "are either stunted in growth, or very tall. All of them have marked deformities of the spine. In all of them the thorax is absolutely or relatively too small."

With these statements I cannot agree. Rickets, like asthma, is a disease of malnutrition, and it would be extraordinary if they were not often combined in childhood. It is in such children too that we find other diseases of asthmatic kindred—such as laryngismus stridulus and paroxysmal bronchitis. But while asthma can often be traced to a rickety and bronchitic childhood, it quite commonly develops in adult life, and then can often be traced to the metabolic upset caused by such conditions as influenza or pregnancy. Salter was more correct than Berkart when the latter says: "Hyde Salter's allegation that the asthmatic physique is entirely the result of the faulty attitudes during the paroxysms is disproved by the fact that the deformities developed before the onset on the dyspnœa, and that they exist not only in the thorax, but often in other parts of the osseous system." Now, apart from the obvious fact that asthma will more distort the chest of a growing child, and especially of a rickety child, than that of an adult, Salter was quite right in pointing out that there is such a thing as senile asthma—asthma developing after 50, typical, and neither renal nor cardiac; and though experience has taught me that he was wrong in giving a very gloomy prognosis of such cases (see Chapter X.), it would be impossible to connect them with rickets. After giving special attention to chest development in asthmatics, I am quite convinced that many of them have splendid chests, and have excellent respiratory capacity. A woman of 43, after twelve years of severe asthma, has a finely formed chest, with no special sign of emphysema, and can, when asked, breathe two to the minute. One of the finest chests I have seen was in a man who developed severe asthma at the age of 31. He can with ease reduce his respirations to eight per five minutes. A boy of 10, finely developed, who has been subject to asthma for most of his lifetime, but is now cured, and whose father has had hay fever and asthma, has a chest expansion of three inches on deep inspiration, excellent for a small boy.

Asthma has a real connection with rickets because of the metabolic error involved; but it has an equally real connection with other conditions, even though we justly stretch our conceptions of both asthma and rickets beyond the ideas commonly in vogue.

There can be little doubt that the changes in the chest wall are largely due to the action on them of the muscles during the forced respiration of the paroxysms; the case (p. 32) of the old man with nearly thirty years of asthma, and rounded shoulders, yet without pronounced emphysema, seems to prove this; but emphysema is another factor. The mode of production of emphysema need not be discussed here. It is recognised that it may arise from repeated bronchitis, or from violent expiratory efforts such as are involved in the asthmatic spasm. It will therefore arise more readily where asthma succeeds years of bronchitis, or where both are combined ;(but, as has already been said, it takes repeated, prolonged and severe asthma to produce emphysema that is readily recognisable clinically.)

The CIRCULATORY changes found in chronic asthmatics probably result from the bronchitis, and especially from the emphysema, rather than from the repeated attacks of spasm. They are more conspicuous by their absence than by their presence; it takes years to produce them. Dilatation of the right ventricle must and does ensue, but it is the exception to find it; what surprises is that we do not find it oftener. No doubt the right ventricle distends during the acute attack; but it responds, as seems evident by the prompt effect of injecting adrenalin; and when the attack is over the heart resumes its normal way. On the other hand I have seen adrenalin fail, and leave the patient weak as if the ventricle were too dilated to respond; the blood pressure failed to rise. In this case there was genuine and pronounced emphysema. Where the ventricle repeatedly responds to such strains it must hypertrophy; and where it fails it must dilate; but no organ stands up to trouble like the heart, and it is long before it signals clinically of failure. The man just mentioned, notwithstanding his twenty-eight years of asthma and his having often to stand gasping for hours till his legs were waterlogged, had no heart disease so far as I could detect.

ARTERIO-SCLEROSIS has been stated to be a feature of chronic asthma; this is a myth. Thickening and atheroma of the branches of the pulmonary artery are found; but so far as the systemic circulation is concerned, the characteristic feature of chronic asthma is a soft artery. The reason is not far to seek. As has been shown, asthmatic blood pressure is generally low; the systemic arteries are, therefore, not strained like the pulmonary. That is one reason for asthmatics being proverbially long-lived; a statement that is approximately true considering the distressing nature of their complaint, and provided they do not become drug-slaves.

Similar considerations hold of their DIGESTIVE affections. Here again we have disorder rather than disease; flatulence and "bilious vomiting" rather than gastric dilatation or conditions requiring gastro-enterosomy; constipation usually, more rarely diarrhœa, rather than enteritis or colitis. These patients are wont to have good appetites and fair digestion; if they gratify them, they pay in asthma. Others who overeat pay in obesity, glycosuria, disease of stomach, thickened arteries or affected kidneys. The chronic asthmatic rarely shows such developments; he gets asthma and wheezes and vomits and starves, and "finds salvation." These digestive disorders do not occur in every case, but one or other of them, especially flatulence, occurs in the great majority, and if they are not subdued the asthma is likely to persist, for they indicate intestinal toxæmia.

One intestinal condition has a special interest in relation to asthma—*Muco-membranous colitis.* Hertz has shown an interesting parallelism between them in respect of pathogenesis—catarrh, spasm, production of mucous casts—and in respect of etiology. "A similar type of individual is liable to the two conditions, both of which may sometimes occur in the same patient, either alternately or simultaneously, or in different members of a family. Attacks of both muco-membranous colitis and asthma may be caused by emotional disturbances, and by trifling external changes." The parallelism may be carried further in that while the bronchial casts contain Charcot crystals, the intestinal contain intestinal sand; and both diseases are associated with eosinophilia. Several of my cases have admitted passing mucus in their stools ; but only one has been a pronounced case of muco-membranous colitis. She had the cachectic look common to both diseases.

CHAPTER IV

THE PERIODICITY OF ASTHMA ; THE URINE IN ASTHMA

THE periodicity of the attacks of asthma is so important to a true understanding of the real nature of the disease that it must be fully considered. Any theory which fails to explain this fails absolutely. Consequently periodicity is denied by some, though how anyone with much acquaintance with the disease could miss one of its most salient features is a puzzle. It was well known to Salter, though what I have called the week-end periodicity does not seem to have been so common then as now ; for it is one of the most common and most significant features of asthma in working-folk. Let us consider the facts.

What is meant by periodicity is that in the chronic asthmatic the attacks of asthma tend to recur at particular times rather than at others ; this is not quite the same thing as saying that they recur at definite intervals with so many hours, days or weeks between. The two main periodicities are the nocturnal and the week-end.

By *nocturnal* periodicity is meant the tendency for the attacks to recur during the night, or rather in the small hours of the morning. This periodicity is quite remarkable, and showed in fully 70 per cent. of my cases. In moderately bad cases of chronic asthma the usual time is between 2 and 4 A.M.; in slighter cases on waking; in severe cases the attacks may anticipate and prevent sleep altogether. In some patients the attacks are practically all of this nocturnal type; in others, while the slighter attacks are at night, the more severe persist through the day as well; very few chronic asthmatics escape nocturnal attacks.

By *week-end* periodicity is meant the recurrence of attacks between, say, noon of Saturday and noon of Monday; very rarely they are postponed till Tuesday; the usual time is Monday morning, though Sunday morning is common; and so here again we have the nocturnal periodicity asserting itself in the week-end—etiologically an extremely significant fact. Many asthmatics, of course, while showing a tendency to this week-end recurrence, have attacks at other times—but the great majority of asthmatic working men and of asthmatic women who earn a weekly wage have their attack mostly at the week-end; a few never at any other time. An analysis of 180 cases of asthma without restriction of class or sex shows that week-end periodicity occurs in fully 33 per cent., but that in working men it occurs in at least 60 per cent., and this is a low figure, for at first I did not systematically inquire for this week-end peculiarity, and it has to be asked for else it will be missed. Schoolboys also show this week-end periodicity, and for a like reason, and not because they are trying to dodge school. Equally remarkable is the fact that when asthmatic men have to work Sunday as well as Saturday this week-end periodicity will not be found; many working men, having noticed this, escape their asthma by systematic outdoor exercise on Sundays.

And here lies the key both to the pathogeny and the treatment of asthma. For what is the weekly life of the working man ? Five and a half days work and feeding, then a week-end of less work and of greater and different feeding. The asthmatic is a man so constituted that he metabolises this excess with more or less difficulty or not at all ; his muscles do not need it ; his other organs cannot deal with it ; to him the result is not, as a rule, obesity, glycosuria or renal disease, but asthma.

This metabolic difficulty, constitutional in some asthmatics, slowly developed in others, varies with the individual ; it may be lessened or increased by the patient's mode of life. Some patients say that if they could just do without eating they would have no asthma ; one lad never had any asthma except dyspnœa some time after meals. Indeed, the direct connection of asthma with meals—I find it in 10 per cent.—is so well known that some writers have gone so far as to divide asthma into different types, peptic, nasal, bronchial, uterine, and so on, according to the immediate and most apparent exciting cause; whereas it is all one. Asthma is the expression of a toxæmia resulting often from intestinal absorption, but also, and mainly, from an error in metabolism. The best proof of this is the week-end periodicity; but if additional proof were wanted from an individual case, perhaps none better than the following could be found, although it seems to contradict the rule just mentioned as to asthmatics and obesity :—

"A well-built man, aged 31, height 5 ft. 10 in., weight 12 st.,

> came to me in 1905 complaining that for four months he had had frequent and severe asthma. His mother and sister had asthma, a brother died of phthisis. His nose (polypi, etc.) was put in order, his diet altered; and for five years he remained absolutely free of asthma. In 1911 his father died of phthisis; a few months later he himself, having let his weight run down to 10 stone, and in one week more to 5 lbs. less, contracted phthisis at the right apex. He set his mind to treatment and especially to overfeeding. During the next six months he put on weight at the rate of 2 lbs. a week, so that he then weighed 13 stone 6 lbs.—*i.e.* an increase of 52 lbs. He was warned of the risks of his asthma coming back; but he did not mind that till it came. He was taking systematically, in addition to three good meals, a pint and a half of cream, and six eggs a day. In July 1912 he had several attacks of nocturnal asthma; his diet was again reduced and they have not recurred; his phthisis has been cured for a year, though the dullness above his right clavicle will always remain; he has no emphysema."

This sort of story might be repeated *ad nauseam*; one more will suffice:

> "An engineer, aged 25, who had had frequent asthma during the previous five years, came in 1906 saying that latterly he had had attacks knocking him off work for the first three days of every week. His meal-hours were most irregular; he had atrophic rhinitis with much crust in both nostrils. His diet and nose were attended to; his asthma slowly became less frequent and severe; he remained free for months till he went on a week-end holiday, determined to enjoy the pleasures of the table, ate a pot of marmalade at one meal and had asthma for the rest of his holiday. For the last two years he has had practically no asthma."

This case illustrates what, as we shall see, is a general rule in asthma, that the attacks are closely related to carbohydrate excess.

Now these periodicities, nocturnal and week-end, connected as they are with periods of repose, and in the case of the week-end with under-exercise and overfeeding, ought to find some expression in the urine; and Bouchard's work along this line seems the experimental counterpart of the clinical facts just stated in connection with asthma. Since Bouchard wrote, much work has been done on the pathological chemistry of the urine, especially in relation to diabetes; but although there has been much research on tissue respiration, and the actions and reactions of oxidases, peroxidases, other enzymes and lipoid membranes, little attention seems to have been paid to what must be a fruitful field in both respects—the tissue respiration and urinary toxicity of asthmatics. Bouchard's work still stands; here are some of the statements he deduces from his experiments. "The urines of sleep are always markedly convulsive; those of the day period are very little or not at all convulsive, but they produce narcosis. What is certain is, that during the day the body forms a substance which, when accumulated, would induce sleep, and that during sleep it elaborates, instead of this narcotic substance, a convulsive substance which, when accumulated, could produce muscular twitchings and induce waking. The poisons of the day period and the poisons of sleep are not only different as regards intensity and quality, they are antagonistic; the one is the antagonist of the other. The toxicity of the urine of sleep being only half of the toxicity of the urine secreted during an equal period of the day, we might think that the urine of repose ought to be less toxic than the urine of muscular effort. But it is the contrary that is true. One day of great muscular activity, spent in the open air, in the country, diminishes the toxicity of the twenty-four hours by one-third, and on that day the toxicity does not diminish only during the time devoted to muscular exercise. The toxicity, which diminishes during work, remains less during the repose which follows this work, and during the sleep which succeeds this day of muscular activity. This fact has an important bearing—it shows that a large part of the toxicity is not attributable to the mineral substances, which certainly are not diminished by the fact of exercise, and that it depends upon organic substances incompletely oxidised, whose toxicity diminishes in proportion as oxidation is more completely effected. We urge upon all the interest which this experiment has from a therapeutical point of view." And from a therapeutical point of view I have proved in asthma the value of these statements, as, from a pathological point of view, the records and analyses of cases given above prove their general truth. If the urines of sleep are convulsive and expressive of a similar blood state, we should expect asthmatic attacks to occur in the early morning—as they commonly do; if active, open-air exercise reduces this convulsive toxicity we should expect asthmatic working men to have their attacks during the lounge and feed of the week-end—as they have; by reduction of the week-end feed, and increase of the week-end exercise, we should expect to help them to get rid of their asthma—and we do.

Before considering certain features of the urine in asthma, it will be well to carry the above argument a little further. If asthma is a toxæmia resulting largely from a maladjustment of food and exercise in certain individuals, we should expect this week-end maladjustment to produce other toxic disturbances than the asthmatic spasm, especially in individuals who are not asthmatic. I have more than once published such evidence, but will repeat and extend it.

EPILEPSY, it is well known, is often, like asthma, nocturnal in its periodicity ; but it is less commonly known that the fits sometimes recur regularly at week-ends, though this periodicity is not so common as in asthma. Now this is important therapeutically, especially in the initial stages of the disease, when there is hope of arresting it ; for epilepsy certainly owns a toxæmic factor, if not a toxæmic basis. Attention to diet, exercise and a weekly dose of calomel, arrested the disease in two brothers who developed fits when about the age of 7, and who have now grown up to manhood ; they had no fits after the first year of treatment. A boy of 11 had had fits for two years, generally at the week-end, as his mother voluntarily expressed it, especially Mondays, in the small hours of the morning, and generally accompanied by severe sickness and vomiting—all three details being on a par with asthma. Restriction of food, increase of exercise at the week-end, calomel on Saturday night, were ordered, with improvement for a short time ; but he inherited a pusillanimous mother who was lax with the treatment, and with him, and he has steadily grown worse. Many years ago, my friend, Dr Alex. Morton, had charge of a lad who lounged about the house on Sundays, and had epilepsy on Monday mornings. Dr Morton changed these habits, and for some weeks stopped the fits till the lad was taken to a consultant who prescribed rest in bed and feeding, with prompt recurrence of the fits. Another boy was noticed by his guardian to have his attacks of epilepsy most frequently on Sundays and Mondays, after spending his pocket money on sweets on Saturday. To complete the record I may add that I had one patient with bad epilepsy and bad asthma ; he died in an asylum. A recent case is a woman of 46, whose asthma began at the age of 13 and is already much improved. One sister has epilepsy ; and her father's sister had epilepsy.

The nocturnal recurrence of epilepsy is well known, but the week-end recurrence in the working class does not, so far as I can gather, seem to have been systematically investigated. The special significance of this is, of course, therapeutic ; if epilepsy is to be treated hopefully, it must be at the beginning, before the cerebral cells have become too prone to respond to the toxæmia.

I have now no opportunity of treating epilepsy, but have no doubt that for it, as for asthma, similar treatment would prove helpful, though not to the same degree—a simple dietary, especially restricted as to carbohydrates and carefully cooked, abundant open-air exercise, well-timed fasting days and mercurials. The "bilious vomiting" well known in asthma, and mentioned in at least one of these cases of epilepsy, is specially significant of a toxæmic factor in both diseases. According to Herter, "bilious attacks" are characteristic of the indolic type of intestinal putrefaction.

Week-end periodicity was a striking feature of the following remarkable case of that variety of

URTICARIA called by Quincke "acute circumscribed cutaneous oedema":—

> "A carter, aged 17, awoke on Sunday, 29th July 1894, with pronounced brawny, painless swelling of one eyebrow; this disappeared towards evening. The following Sunday morning he found similar swelling of lower part of forehead and of both eyebrows, and towards evening of lower lip. During next day the swelling disappeared. Again the next Sunday, when I first saw him, he had similar swelling of upper lip, as if from a wasp sting, so that tip of lip was on a level with tip of nose. This disappeared during next day; yet the following Sunday a similar recurrence with a similar result. He was treated with purgatives and had no further trouble. Now on Saturday and Sunday this patient had more food and much less work than on other days, and it is to be noted that until seven weeks before his first attack he had been a shepherd, always in the open air, and always on the same diet and work seven days a week."

Here we have exactly the conditions mentioned by Bouchard as likely to produce a toxic condition of the urine, as also the conditions which I have shown lead to week-end asthma; but the special interest of the case in relation to asthma is that many authorities, as we shall see in a later chapter, hold that a similar vascular condition in the bronchi or bronchioles causes the "spasm" of asthma. It is of still further interest in relation to those cases of laryngeal oedema, suffocative and often fatal, which seem so baffling to treat, but which certainly could be prevented if the toxæmia leading up to them were properly handled. For a toxæmia in the case just mentioned seems beyond dispute.

We have the same week-end periodicity, and the same obvious explanation in the **DISEASE OF HORSES** mentioned by Woods Hutchinson. It is called " Monday morning disease " by the American ostlers because horses take it on that day. It is also called " black strangury." Broken-down hæmoglobin or hæmatin appears in the blood and urine.

Here is Hutchinson's description of the disease :

> " Its onset is marked by sudden stiffness and soreness, rapidly developing into complete loss of power in the muscles of the back and hind quarters, so violent and swift in its course as to have been at one time regarded as a form of paralysis. The disease is well known and greatly dreaded by horse owners, as it is not only frequently fatal—often barely 30 per cent. recovering—but seems specially prone to attack vigorous horses in the prime of life. In spite of the most careful examination of the affected muscles, no causal organism has yet been discovered, and we are completely in the dark as to the etiology of this strange degenerative myositis. The only predisposing condition known is over-feeding and idleness after work, as it seems to attack city work horses in high condition and stallions just after the breeding season. Indeed, in many of our large American carriage and express stables it is known as ' Monday morning disease,' as it is most apt to appear on that day of the week after thirty-six hours' rest and high feeding. It does not appear to be infectious, although it will often attack three or four horses in the same stable within a few days."

Here we have an excess of carbohydrate brought to muscles in the worst of surroundings for these being able to metabolise it, with the result that they are overwhelmed. It is an extreme case, extreme as to the quantity or the nature of the poison ; in asthma the metabolism is probably carried further, but not far enough, so that the less severe form of poison produces an attack ; at any rate the successful results of treatment seem to support this idea.

Lastly, if this toxæmic conception of asthma with its week-end manifestations be true, it would be strange not to find evidence in the urine. Now ALBUMINURIA may occur at the week-end, without asthma, and it is quite likely that much mystery may have been made about many cases of cyclical albuminuria out of a very simple matter. Fifteen years ago my attention was drawn to this possibility by the following case:—

> "A grocer, aged 24, came to me one Sunday about 1 P.M. to be examined for life insurance. Albumin in the urine was found; it was also found that he had been working late the night before and had lain in bed until he came to me. The insurance company asked for three more examinations of urine. I asked the patient to come any day but Sunday or Monday, found no albumin, and passed him as a first-class life. Complying with a further request he gave me samples of urine on two subsequent Sundays; albumin was found in one."

In the case of another lad with asthma at the week-end, and only at the week-end, who declined treatment but who went to another doctor for an insurance examination, albuminuria was found. The examination was on a Sunday more than once; the company asked for three further examinations of the urine; I advised the examining doctor who consulted me on the matter to do these examinations during the week. This was done, albumin was not found and the life accepted. Such cases are probably much less rare than is commonly imagined. Whether morning albuminuria is occasional in asthmatics I have not investigated; but albuminuria does occur in at least 4 per cent. of the cases, and probably in a much higher proportion. It is usually slight, and most apt to occur when asthma is bad; when the attack is well past, and especially when the asthmatic state—in other words, the toxæmia—is got under by appropriate treatment, it mostly disappears. It did not, however, in the following case, which had been mistaken by the medical attendant for renal asthma :—

> " A man of 70 came complaining that asthma had begun eighteen months previously, after severe exertion in a storm. Latterly it had been very commanding, waking him almost every night about 2 A.M. with extreme dyspnœa. Blood pressure was 160, heart sound, cachexia typical ; a constant but slight haze of albumin was found in the urine ; but specific gravity was usually about 1015, quantity fair. Under treatment, including removal of nasal polypi, the pressure came down to 130, the asthma disappeared ; but the slight trace of albumin remains."

Here, apart from the other features of the case, the moderate quantity of urine and medium specific gravity, together with such a small trace of albumin, should have prevented one from mistaking such dyspnœa for renal asthma.

A similar mistake was made in the case of a clergyman, aged 42, who had been treated by several doctors.[1] He had had asthma somewhat intermittently for thirty years, and latterly distinct albuminuria ; blood pressure only 120. I resected his septum and otherwise treated him. His asthma cleared up, and he was able to return to his work in one of the colonies. An interesting feature of the case was that while his attacks were typically nocturnal, they avoided Sunday, *his* working day. On the whole, the feature of asthmatic albuminuria is its slightness and intermittence.

The reader will readily understand, after this exposition of the prevalence of week-end periodicity

[1] He had been given a very gloomy prognosis.

in asthma and other diseases, the importance of week-end fasting as initial treatment. Thereby we anticipate and in the end prevent the recurrence of the disease.

Consider now other urinary changes in asthma. In my early paper on asthma I published tables showing that in asthma there is a relatively increased excretion of uric acid, usually, though not always, associated with the paroxysm. I will not repeat these tables here; for, as Burian and Schur and, in this country, Walker Hall have conclusively shown, estimations of nitrogen output, and especially of purin output, are of little value except account be taken of their intake in the food; and such estimations, difficult always in private practice, are doubly difficult in a disease like asthma. But these results, imperfect as they are, have a distinct value in showing the disturbed and imperfect metabolism of asthma, and in this way: as Walker Hall has shown, 50 per cent. of the ingested or exogenous purins reappear in the urine; therefore, we would expect the excretion of uric acid (trioxy-purin) to be greater during a feeding than a fasting period. This, of course, would be partly influenced by the rate of excretion. Now, I have repeatedly found that during the paroxysm, which is usually a time of fasting, and at night, when the normal excretion of uric acid is less than during the day, the uric acid area ratio is double or treble of the normal—*e.g.* 1-12 or 1-15 instead of 1-35.

One patient in 24 hours, asthma-free, excreted 0·2929 gm. uric acid; in 10 hours of asthma 0·5076 gm., nearly double the amount of uric acid in less

URIC ACID IN ASTHMA

Case	Specimen of Urine	Time during which Urine was collected	Duration of Asthma	Quantity of Urine in c.c.	Urea in gms.	Uric in gms.	Ratio of Uric Acid to Urea
I	A	24 hours	None	772		0·2929	
	B	10 ,,	10 hours	256	9·663	0·5076	
	A	10 ,, 7 P.M.-5 A.M.	None	313		0·1094	
	B	10 ,, 7 P.M.-5 A.M.	10 hours	256	9·663	0·5076	1 : 19
II Female, weight 91 lbs.	A	9 ,, 5 P.M.-2 A.M.	9 hours	340	5·797	0·3848	1 : 15
	B	14 ,, 2 A.M.-4 P.M.	None	284	5·52	0·1045	1 : 53
III Female, weight 140 lbs. Bronchitis, emphysema, no asthma	Day urine	12 hours, average for 3 days		388	7·966	0·1692	1 : 41
	Night ,,	,, ,, ,,	,,	558	10·366	0·1413	1 : 73

than half the time; or, to put it still more strikingly, part of the urine in both periods was taken from 7 P.M. to 5 A.M.; in the asthma-free period the quantity was 313 cc. and the uric acid 0·1094 gm.; in the asthma period 256 cc. and 0·5076 gm., nearly five times the amount of uric acid. In the latter period note the diminished quantity of urine; urea was 9·663 gm., giving a ratio with uric acid of 1-19 instead of 1-35.

Similarly, in a lady weighing 6½ stone, during 9 hours asthma we got urea 5·797 gm., uric acid 0·3848 gm.; in the following 14 asthma-free hours 5·57 gm. and 0·1045 gm.—*i.e.* during the 9 hours of asthma nearly three times as much uric acid as during 14 hours asthma-free. In the asthma period the ratio to urea was 1-15 as against 1-53 in the asthma-free period.

This lady was contrasted with another weighing 3½ stone more, who had had years of bronchitis and emphysema, but never asthma. In 24 hours her urea was 18·332 gm., uric acid 0·3105 gm.; as against 0·3848 gm. uric acid in 9 hours asthma and 0·5076 uric acid in 10 hours asthma of the two cases just quoted.

Subsequent experience has gone to support the view that asthmatics as a class have a disturbed nitrogenous metabolism, tending to uric acid excess and deposit in the urine. A boy of 3, with bad asthma and eczema, and a family history of the same, had 0·52 uric acid, 10·55 gm. urea (ratio 1-12) and increased indigogens. This close relationship of uric acid to asthma is not always present, being sometimes postponed, but it is so general as to be of distinct significance.

However much these observations be criticised,[1] and the value of the uric acid urea ratio cried down, the criticism in both cases is to some extent discounted by the fact that they do not stand alone but, as we shall see presently, are in line with other evidence of urinary change pointing to disturbed metabolism and toxæmia in asthma.

Such observations as the above would be much more interesting if regard were paid to the part played by endogenous and exogenous purins in the disturbance. What has been suggested so far is that, as indicated by the uric acid, there is a disturbed nitrogenous output associated with excess of carbohydrate intake—a fact well known to gouty subjects, but in asthmatics resulting in the production of intermediate products that cause asthma; it is as if the simpler, more easily oxidised carbohydrate molecule robbed the more complex, less easily oxidised proteid molecule of oxygen. That these poisons are sometimes at least associated rather with the ingested proteids than with the endogenous purins is suggested by the following observations on the ethereal sulphates in asthma, made for me by my friend, Dr Hugh Morton. I have already mentioned increase of indigogens in asthma; they are associated with processes of decomposition within the body, particularly increased intestinal putrefaction; their increase is best shown by that of the ethereal sulphates, the normal ratio of which to the remaining sulphates is given by Sahli as 1·10.

In Table I we have a man having little asthma during a day of 12 hours excreting 130 cc. urine,

---

[1] The uric acid excess is not really great.

ETHEREAL SULPHATES IN ASTHMA

Case	Specimen	Time of Urinary Excretion	Asthma	Quantity of Urine in cc.	Sulphates in gm.			Ratio	Purin Total	N in gm. %
					Total	Ethereal	Inorganic			
I	A	12 hours, 8 A.M. to 8 P.M. 7th June	Little asthma	310	0·992	0·124	0·868	1 : 7	..	..
	B	12 hours, 8 P.M. 7th to 8 A.M. 8th June	Bad asthma	350	1·12	0·28	0·84	1 : 3	..	..
	Totals	24 hours	..	660 (=23 oz.)	2·112	0·404	1·708	..		
II	A	12 hours, 8 P.M. 4th July to 8 A.M. 5th July	Two hours asthma	275	0·99	0·11	0·88	1 : 8	0·0537	0·0195
	B	10½ hours, 8 A.M. to 6.30 P.M. 5th July	Asthma just begun when specimen stopped	440	1·5485	0·1405	1·408	1 : 10	0·0959	0·0218
	C	4 hours, 6.30 P.M. to 10.30 P.M. 5th July	Bad asthma whole time	150	0·504	0·084	0·42	1 : 5	1·0218	0·0185
	Totals	26½ hours		865 (=29 oz.)	3·0385	0·3345	2·708	..	0·1774	..

and a ratio of ethereal to remaining sulphates of 1·7; but during a night of 12 hours and bad asthma a little more urine (this is unusual) with a ratio of 1·3. Note that the total amount of urine for 24 hours is small—23 oz.

In Table II another patient shows during 10½ hours practically asthma-free 440 cc. urine and a ratio of ethereal to other sulphates to 1·10; whereas during 4 hours of bad asthma the urine was 150 cc., and the ratio 1·5.

From these tables, and from figures given in the remarks on uric acid, another fact connected with the metabolic upset of asthma can be shown—diminished output of urine, 12, 15, 20 oz. of urine in 24 hours is no uncommon thing in asthma; frequently no urine will be passed at all in 12 hours.

This scanty urine gives a thick deposit of urates or uric acid, less frequently of oxalates. This oliguria and not polyuria is the characteristic of the asthmatic paroxysm. Polyuria, however, sometimes does occur and is so striking as to be mentioned in all the text-books. It is usually preceded or followed by very scanty outflow; it has not been explained. But let us consider all the points together.

Oliguria, albuminuria, increase of uric acid relatively to urea, of ethereal sulphates relatively to the others, do not occur in every case of asthma; but two or more of them so often characterise the spasm, and are so linked together, that we must judge them to be essentially connected with its cause.

It is not suggested, as has been imputed to me, that excess either of uric acid or of ethereal sulphates is the cause of asthma; but we have in these four points fair evidence, apart from others already advanced, and to be yet advanced, that in asthma proteid metabolism is not carried to its usual end-products and that probably intermediate products of an abnormal kind are formed which set up the asthmatic spasm. As a matter of actual practice we find that when we rid the patient of his asthma we mostly clear his urine of these abnormalities.

A possible explanation of the polyuria of asthma may be mentioned here. Assuming for the moment that the toxæmia of asthma may result either from intestinal putrefaction of proteid foods, or from a metabolic error of the tissues themselves, let us briefly consider the latter. The metabolism of the nucleo-proteids results in splitting off the nuclein molecule from which in turn come the purin bodies (Nucleus $C_5 N_4$). Of these uric acid is 3-oxypurin; the less highly oxidised purins, xanthin and hypoxanthin also occur in the urine in minute quantities. They are more diuretic than uric acid, for they occur more abundantly, with a copious flow of urine, while uric acid is relatively more abundant in concentrated urine. The methyl-purins, which occur in tea, coffee and cocoa, are highly diuretic. The final stage of purin oxidation is urea. Now, asthma so far as it is produced by endogenous purins is a disease of defective oxidation. Is it not likely that the polyuria which introduces some attacks of asthma results from the production of one or more of the more diuretic purins, especially as later there is relatively excessive production of the most highly oxidised of them, uric acid?

For my information on the purins, I am indebted to Walker Hall's " Purin Bodies," and with his kind permission I give here his scheme of the probable cleavage of nucleo-proteid (p. 16). We see in it also a possible explanation of the albuminuria which characterises some attacks of asthma.

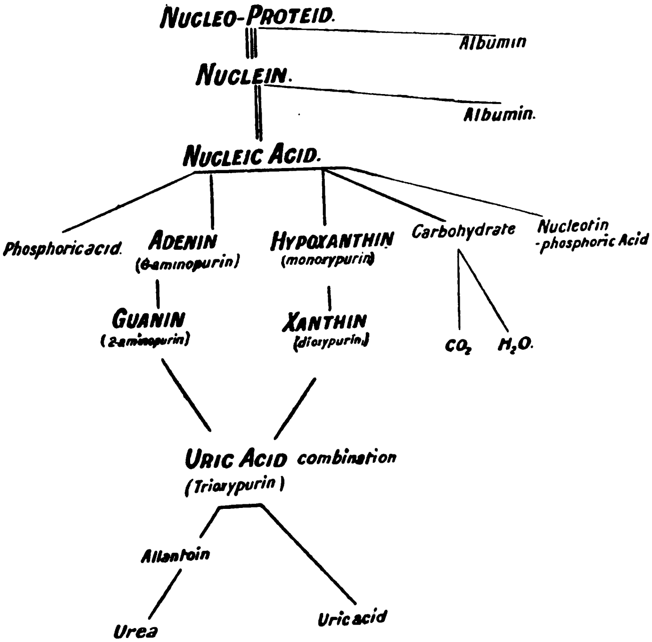

FIG. 4

Face p. 60

CHAPTER V

ATYPICAL ASTHMA AND ALLIED CONDITIONS

SOME evidence has already been given for considering asthma as a toxæmia resulting partly from intestinal putrefaction of the proteid foods, but also from an error in proteid metabolism—two things that are apt to go together. Further, this error in proteid metabolism, partly evidenced by the uric acid and albumin in the urine, as mentioned in the last chapter, is closely related to carbohydrate excess, not only in asthma, but in several other conditions. Instances of this have been given, and I must content myself by adding that the case histories, especially those of children, when carefully gone into, almost always show excess of carbohydrate in the diet: sweets, preserves, "pieces" between meals, or the interpolation of a cake and tea meal between the staple meals, or the addition of a meal on going to bed. Allowing that dietetic sinners are not always meted out the same punishment, but that the asthmatic, because of his biochemical tendency, pays in asthma, the connection of this carbohydrate sin with asthma is doubly proved. It is proved by the fact that if you cut down this excess, and increase the exercise, you straightway help the asthma; it is proved again by the fact that transgression of this rule brings back the asthma. See for instance (p. 33) the case of the boy who got rid both of eczema and asthma by altered dietary, but who had both return when his grandmother supplied him liberally with sweets; and again (p. 44) the case of the engineer who also by altered dietary got rid of severe asthma, but had prompt recurrence on eating a potful of marmalade. Other instances will follow; but if further proof be needed the reader will find it in the chapters on Prognosis and Treatment. Treatment that will cure 75 per cent. of all cases of asthma, and much nearer 100 per cent. of cases of uncomplicated asthma, cannot be gainsaid. And similar treatment is found effective not only in that close ally of asthma, eczema, but in those atypical varieties of asthma which we shall presently consider.

What has to be steadily kept in mind regarding the conditions dealt with in this chapter, is that catarrhal conditions of the respiratory tract may result from assaults from within as well as from without, may be toxæmic as well as microbic in origin. They may result solely from an altered soil as well as from a specific seed, though such a soil will the more readily grow the seed. While I would not say that too much attention has been paid to the seed, to the microbic origin of these diseases, it cannot be too strongly emphasised that far too little attention has been paid, especially in the matter of treatment, to the soil, to the toxæmic conditions that not only predispose to these diseases, but even cause them. For instance asthma has been treated by vaccines. This may not be futile procedure, but it is seldom necessary and putting the cart before the horse, or at least putting the horse tail foremost into the cart.

An excellent example for the thesis just stated is the commonest atypical form of asthma, the recurrent bronchitis of children. As Gee said, this afebrile, or only slightly febrile, bronchitis *is* asthma, though at first there is nothing spasmodic about it. It results from the same evil feeding, want of exercise and defective metabolism as the typical asthma of adults. Yet how seldom are these poor little wretches treated on this rational basis? They are put to bed, coddled, steamed, poulticed, kept in pokey rooms, "at an equable temperature," fed on an atrocious dietary, called "milk foods" instead of "slop poison," that only makes them worse. What helps to blind us to this error is that in these cases the temperature is sometimes up, though in my experience this is the exception rather than the rule. Hale White has recently pointed out that there are sometimes in children obscure attacks of fever, which he has called carbohydrate fever, for which no cause can be found save carbohydrate excess, and which promptly disappears on stopping that excess; Berkart has also shown that pyrexia sometimes accompanies asthma. What happens in these bronchitic children is that they are stuffed with excess of farinaceous food, cooked in an albuminous menstruum, milk or milk and eggs, which makes it difficult to digest and promotes intestinal putrefaction. By-and-by they develop what is called "bronchitis"; for this they are kept indoors and so deprived of the muscular exercise and abundance of oxygen which would help them to metabolise this food. In longer or shorter time—usually years, unless there is a strong hereditary tendency to asthma—these attacks are

Important

marked by paroxysmal dyspnœa ; they get what we have been wont to recognise as asthma. Where asthma has developed in childhood or youth this has been the almost invariable history. The connection with slop feeding can often be traced. The following case illustrates this excellently :—

> "A lady of 29 came to me in 1911 with a history of asthma for twenty-seven years ; attacks lasting two or three months on end, then a similar period free. She had had her nose cauterised ten years previously without benefit. She had a beautiful complexion, but otherwise was typical—under weight, rounded shoulders. The father has asthma ; so also have two of her sisters and a brother ; these, when children, were all brought up on food of the sloppy kind. One sister has two children with asthma, similarly brought up. The lady herself had been coddled for her attacks and treated by vaccines. The regimen of her life was altered and she has remained well. It is worth noting, as showing how catarrhal processes extend, and how treating the results of evil feeding will not remove asthma, that her brother and sister had nasal polypi removed without improvement of their asthma ; her own nose was normal."

Many cases might be given of the growth of the carbohydrate, hot-house bronchitis of children into typical asthma as the years passed, or of the combination of such bronchitis with eczema in the children of asthmatic parents. It is worth while pointing out that in overfed adults, especially in fat women, the wheezy bronchitis that is so common, results from the dietary, want of exercise and defective oxidation, and can be cured by attention to these points rather than by drugs. Such patients sometimes tell me they have themselves noticed this. The toxæmia stops short of the asthmatic paroxysm. When this develops they are apt to become thinner, partly because of the compulsory starvation during the attacks, partly because of the greater disturbance of tissue metabolism by the greater toxæmia.

The great point of interest then, both in adults and in children, is that first we have a catarrhal, then a spasmodic, process arising as the result of excessive carbohydrate intake and defective oxidation of food and tissue. We find the parallel of this in the larynx, in spasmodic laryngitis (laryngitis stridulosa or pseudo-croup) and laryngismus stridulus. The latter is really asthma of the larynx ; the former is, in many cases at least, the catarrhal form of it. American writers are apt to poke fun at British physicians for confusing the two, albeit they admit that laryngismus is more common here than there ; but the confusion is justified, not only by the facts, but even by the American description of them. I shall follow Illoway's description of both in Starr's "Diseases of Children," pp. 844-864. He himself accounts for the rarity of laryngismus in the States "by the fact that pap feeding is almost unknown" there. What I have to show is the connection of spasmodic laryngitis with dietary similar to that which causes infantile asthma, and so of both diseases with each other.

Both laryngeal affections are affections of children, and of children whose nutrition is defective ; both are most prevalent in the cold months of the year ; both are characterised—like asthma—by the sudden onset, during sleep, of dyspnœa, but this dyspnœa affects the larynx, causing stridor or crowing—laryngospasm ; the accessory muscles of respiration are called upon. Illoway says that laryngitis stridulosa is readily distinguished from laryngismus by the cough, the hoarseness in the voice, and the fever—phenomena altogether wanting in laryngismus stridulus. In the latter, which he calls a pure neurosis, he says the larynx is generally normal; but under the heading of pathology he says: "In the larynx traces of catarrh have been found; occasionally a croupous exudation upon the larynx and trachea; very rarely ulceration."

In laryngitis stridulosa tumefaction of the mucous membrane with exudation is readily admitted. So, after all, is it not a distinction without much difference? Do not the clinical pictures, and even the pathological appearances, shade into each other? In my experience they do. The last case of laryngismus I saw had slight hoarseness and cough; this would, of course, be ascribed to mistaken diagnosis, the hoarseness and cough being taken as proof of tumefaction. But nobody can deny the co-existence of spasm in such cases of laryngitis; nobody has ever seen the larynx during laryngismus to be able to say there is no tumefaction, and post-mortem evidence for its occasional presence has just been cited. Also, acute oedema of the larynx is a known cause of sudden dyspnœa and of fatal suffocation in adult life. In fact the whole question is on a par with the controversy as to the pathological condition of the bronchi and bronchioles during the asthmatic paroxysm, to be discussed in the next chapter.

Further, it is said that laryngismus is an entirely different disease from infantile asthma. Now the same child may have laryngismus one week and infantile asthma, or so-called bronchitis, the next. The child of a medical friend had the combination;

he took to watching the relation of the attacks to diet, and found he could induce them at will by keeping her indoors and feeding her for three days on milk puddings and jam—the very factors that we have seen induce asthma. Other cases might be mentioned.

It is well known that a large proportion of cases of laryngismus occurs in rickety children. Berkart has pointed out the frequent connection of rickets with asthma ; but the observations of Flesh, quoted by Illoway, on this and other points connected with laryngismus, could scarcely be bettered, and are so much in line with what I have been saying with regard to asthma that I give them all.

Laryngismus is most prevalent in the cold months of the year. "Some would have this frequency due to the greater prevalence of catarrhal conditions at this period. According to Flesh, it is due to the fact that children are kept much more confined to the house during these months. The experience of Mr Robinson seems fully to corroborate this ; he recommends the free exposure of the infant out of doors for many hours daily to a dry cold atmosphere, and, if the air be dry, the colder the better." "Flesh admits the very frequent coincidence of laryngismus and rickets, but does not believe in the causal relation of the latter to the former. For him, not the rachitis, but the factors that give rise to the cachexia, are the causes of the laryngeal spasm. Faulty nutrition and injurious food, these and nothing else, are the *fons et origio* of spasm of the glottis."

All excellent gospel. As in asthma of the adult there is other evidence of nervous disturbance than the bronchial spasm, such as exaggerated knee-jerks, so in the less stable system of the child we have in addition to the pronounced spasm of laryngeal asthma, carpopedal spasm, rolling up of the eyes, and sometimes clonic spasms, and a general eclamptic seizure. The evidence for defective oxidation Illoway himself gives: "In a small number of cases, and more especially of those occurring after the third year, no special cause for the cramp can be discovered. According to my observation, a hot, vitiated atmosphere in the sleeping apartment, with the doors and windows tightly closed, will account for some of these. In support of this view I would recall here the influence of this factor in the production of trismus." "Flesh deprecates, as a rule, all interference with the child, with the exception of evacuating enemata. All the other various measures resorted to are not only not beneficial but injurious." He gives them lean meat and reports that in the last twelve years he has lost but two cases.

I repeat that I am not contending that there is not a true spasmodic laryngitis of children, and a true bronchitis of children of genuine inflammatory nature originating from external causes, such as "cold" and microbes; but in the great majority of cases these causes are subsidiary to the toxæmic.

We have seen that the toxæmia of asthma produces other symptoms than the "spasm," that it produces, especially in childhood, other disease forms than typical asthma; it will not be surprising to find that even in the adult there may exceptionally be very serious manifestations of such toxæmia. The laryngismus of childhood frequently kills; the typical asthmatic spasm of the adult does not. So far as I am aware, Gee was the first to point out the kinship of acute pulmonary oedema with asthma. I quote from my paper of 1900.

> " Gee, under the heading of ' Paroxysmal Bronchial Flux,' quotes a remarkable case mentioned by Beddoes, where a woman was on four different occasions seized by attacks like spasmodic asthma, but much more violent, and on their remission attended by very copious discharge from the bronchi. On the fourth occasion the dyspnœa developed very suddenly, and she appeared within five minutes almost suffocated and became unconscious for two hours, during which time a very large quantity of frothy ' serum ' tinged a little with blood was discharged without any visible effort by the mouth and nostrils. Then she began to cough again, and altogether put up 3 or 4 pints of fluid. At the end of three hours she became conscious and slowly rallied.
>
> " The following seems a similar case, though the patient never had asthma. It is the more interesting as being probably of toxic origin. A stoutly built lad, who drove a butcher's cart round outlying districts, and who had no food but an apple between breakfast and supper, which was a hearty one, went to bed on the evening of 25th August 1896. He looked a little pale. Next morning he was found unconscious in bed, breathing loudly, with white foam coming from mouth and nostrils. His chest was full of bubbling rales which could be heard in the next room. There was no dullness about the lungs, the heart could not be heard for rales, but was not enlarged. He could not be roused. The pupils, when the eyelids were lifted, were found to be equal and somewhat contracted ; there was no squint ; the eyeballs were rolled slowly from side to side. There was no paralysis, as patient occasionally moved his limbs. He vomited a little clear mucus while I was there, and his pillow looked as if this might have happened during the night. His bowels moved involuntarily at the same time as he vomited. Six ounces clear urine withdrawn by catheter gave sp. gr. 1017 albumin, and a reaction to Fehling's solution (? sugar). He remained in the same unconscious condition all day. The rales gradually diminished, and by midnight were nearly gone, but the respirations remained very fast, 80 per minute,

> the pulse rate being about the same. The temperature in the morning was 99 (pulse 120), at noon temperature was 101·5; at 4 P.M. 99, at 6 P.M. 101·5, at 10 P.M. 99. The teeth were rigidly clenched till the evening, when he yawned, and the tongue was seen to be foul. A pint of urine withdrawn in the evening gave the same reaction for albumin and (?) sugar as in the morning. Patient was seen by four doctors, who all agreed he would die. So his mother, when she arrived from the country, burned his abdomen with hot applications, and next day, 27th, the patient slowly rallied, and towards evening tried to mutter a response to questions. Fæces were passed in bed twice and urine once. The urine now got by catheter contained no sugar or albumin. There was still slight cooing rale in chest. On the third day he was conscious, but somnolent; respirations 35, pulse 72. Throughout the illness he was of good colour. The burn of his abdomen took three weeks to heal. Recovery was complete. This sudden onset in a previously healthy lad and the complex symptoms seemed to point to a profound toxæmia."

Dr Dunlop, Shettleston, kindly gives me the following case; its asthmatic nature is clear:—

> "A woman, aged 37, multipara, dated her first attack, like many asthmatic women, to her first pregnancy, when she was 22. Lately she had become very liable to attacks; and was relieved by morphia. She was thus treated during a recent attack; after seven days a little mucus began to come up and she seemed improving. Four days later she became comatose and cyanosed, putting up great quantities of watery sputum without effort. In five minutes this would fill a one-pound jelly jar. In half-an-hour this diminished, but became blood-stained; the quantity remained excessive for six days. As the urine was very scanty, loaded with urates, and slightly albuminous, diuretin was given, when the urine began to flow, cyanosis vanished, expectoration and dyspnœa ceased. During the attack there was pain in chest as if from pleurisy; temperature was raised; there was no decided leucocytosis, but a well-marked eosinophilia."

Note the eosinophilia here as in asthma.

The asthmatic nature of many cases of paroxysmal pulmonary oedema is established by their alternation in two of the above cases with asthma. In the following summary of the main features of the condition as given by Stengel and serving to distinguish it from other forms of acute pulmonary oedema, it will be noted that with the exception of the pulmonary oedema and the serous exudation, all the points apply to asthma. They are: sudden onset, usually with slight provocation, the evidence on examination of intense pulmonary oedema, the expectoration of quantities of frothy and blood-stained serum, and the repetition of such attacks without intercurrent complications. To these should be added the fact that the seizures occur as a rule in the evening, or during sleep. As we have seen, blood-stained expectoration and angio-neurosis occur in typical asthma.

Certain other conditions call here for slight reference. Some asthmatics show a more inherent and profound defect of nitrogenous metabolism than that connected with excessive carbohydrate intake and hothouse living.

Clinically, the two most important instances are those patients to whom eggs and diphtheria antitoxin act as acute poisons; this idiosyncrasy is now spelt anaphylaxis; to such patients eggs cause pain, sickness, vomiting, choking, rashes. The symptoms from the injection of diphtheria antitoxin (horse serum) are similar; but in asthmatics they are apt to occur after the first injection, whereas in ordinary cases they do not occur unless the patient has been sensitised by an injection eight or ten days before, usually a week longer.

Goodall has an excellent paper on the subject, from which I quote, especially to draw attention to the typical symptoms induced, as also to the relationship with the class of acute pulmonary oedema just mentioned, and also by way of proving the view I have, during the last dozen years, expressed of the nature of asthma: "Injection of a foreign protein into an animal renders it peculiarly sensitive to that protein. The protein may be of any kind, animal or vegetable, such as blood serum, white of egg, milk and bacterial extracts." The minuteness of the dose is often remarkable, and in relation to the possibilities in asthma-toxæmia, important: "the injection of $\frac{1}{1000}$ cc. of horse serum into a guinea-pig renders the animal so sensitive that the injection of 3 or 4 cc. a fortnight or more afterwards will almost invariably cause rapid death," with symptoms closely resembling a bad attack of asthma. Goodall quotes the case of an asthmatic doctor, who had an idiosyncrasy to horses, and who could not go near a horse or into a stable without getting an attack similar to, but milder than, one that followed a prophylactic injection of 1000 c.c. of diphtheria antitoxin. Within fifteen minutes there were intense irritation of nose and eyes, constant sneezing; then coughing, urgent dyspnœa and wheezing, as in an attack of asthma. Soon complete collapse ensued; cyanosis, stertorous respiration, streaming nose, pulseless wrists. He slowly rallied, and in six [illegible] a half hours was well but for a spreading oedem [illegible] he site of injectio lasting three days.

Gillette has collected [illegible] cases, asthmatics; 16 fatal [illegible]

"In some cases, [illegible]
reaction follows a [illegible]

affection of the respiratory mucous membrane like the urticaria which comes out at the same time all over the skin." To the frequency of urticaria in asthmatics I have already referred, and in my paper twelve years ago I argued on these lines for the view that part cause of the dyspnœa was, in some cases at least, a tumefaction of the bronchial mucous membrane. Further, it is to be noted that in these anaphylactic conditions there is, as in asthma, eosinophilia.

The condition called angio-neurotic oedema must also be mentioned. As I have shown (p. 49), it may, like asthma, have week-end periodicity, thus establishing its connection with proteid metabolism, or proteid putrefaction. Many fatal cases attacking the larynx and adjoining parts and causing death by suffocation have been published. It may attack the bowel, causing acute obstruction.

Whiting and Edgeworth have published papers showing how this tendency sometimes runs in families. The latter emphasises the cyclical recurrence in many cases, as in asthma, and adds : " General oedema in infantile diarrhœa may be due to a direct action of absorbed poisons on capillary walls. This suggestion would bring such cases into relation with those of ' toxic ' oedema produced by certain articles of diet (*e.g.* shellfish) or by drugs (*e.g.* potassium iodide), and with those of urticaria of intestinal origin."

Two points of practical importance arise from these considerations :—

(1) The giving of horse serum, whether diphtheria, antitoxin or otherwise, for the treatment of asthma, as is sometimes done, is to be deprecated, especially

where there is idiosyncrasy to eggs, fish, shellfish or horses; where diphtheria is so bad as to make the use of antitoxin imperative, the serum should be of specially high potency, so that its repetition shall not be required; if possible it should be prepared from some other animal than the horse; the injection should be prolonged over ten to fifteen minutes, as this is said to minimise the risks.

(2) As I shall show, asthma can in most cases be absolutely controlled by due attention to dietary, and efficient open-air exercise, and also by occasional fasting; it therefore seems worth while to suggest that, in those cases hitherto known as angioneurotic oedema, particularly where it occurs in families, similar attention to diet, exercise and fasting would be wise preventive treatment, possibly lifesaving.

CHAPTER VI

ASTHMATIC DYSPNŒA ; ITS PATHOLOGY

Two views of the exact mechanism of the asthmatic "spasm" are tenaciously held, and, rising out of the recent discussion on asthma at the British Medical Association, a terrible logomachy ensued, the combatants stoutly maintaining that their view of the shield was the only possible one. On the ground that not only chloroform but ether, although it tends to cause vascular fullness, stops the asthmatic paroxysm, Brodie and Dixon in their paper in 1902 argued for a spasmodic and against a vascular explanation of it. Hare reversed the argument ; he quotes a case where ether had to be changed for chloroform in an asthmatic undergoing operation, owing to the cyanosis and wheezing induced by the former. Surely a hyperæmic bronchus or bronchiole is more liable to spasm than one that is normal.

In my paper of 1900 I suggested that two factors contribute to the pulmonary condition : spasm of the muscular coat of the smaller bronchioles and smaller bronchi, and turgescence of their mucous membrane. In 1910 Yankauer reported that "examination of the bronchi during an attack of spasmodic asthma shows that the mucous membrane is congested, and that the lumen is narrowed by spasmodic contraction of the muscular coat."

Such observations are difficult, and need corroboration; for obviously it is difficult to pass a bronchoscope on a dyspnœic patient, and any anæsthetic used is apt to abate or annul spasm; even when the tube is passed all that one sees is the comparatively large bronchi, not the finer tubules where the sibilus arises. I have repeatedly tried bronchoscopic examination during an attack of asthma. What commonly happens is this. The glottis is wide if the attack is severe, and with the ordinary laryngoscopic mirror the trachea can be seen to be injected down to the bifurcation. But the moment you try to pass the bronchoscope in such a dyspnœic patient, coughing is set up, and you have to withdraw the tube. If you then procure insensitiveness of the larynx by swabbing it with cocain and adrenalin you can pass the bronchoscope, but the asthma has stopped and the tracheal injection has disappeared. By educating the patient, or getting a specially insensitive one, it may be possible to pass a bronchoscope without local anæsthesia, but I have never had this good fortune. A general anæsthetic would, of course, stop the spasm and defeat the purpose of the examination. Presumably the important seat of the "spasm" is the bronchioles and smaller bronchi; these will never be seen through any bronchoscope, or through any other instrument, during an asthmatic spasm. It is therefore worth while to consider the various theories. For the following list I am mainly indebted to Goodhart's excellent summary in Allbutt's "Medicine":—

(1) There is spasm of the muscular coat of bronchi and bronchioles (Reisseissen, Gairdner, Salter and many others).

(2) There is turgescence of the mucous membrane lining these tubes (Bree, Gee, Hare and others). Sir Andrew Clarke regarded the spasm as due to vasomotor neurosis of this lining membrane.

(3) This turgescence is an acute, rapidly spreading form of inflammation, accompanied by a croupous exudation, forming the tough plugs which characterise the asthmatic sputum, and which tend to aggravate the obstruction (Berkart).

(4) There is exaggeration of the normal respiratory action of the muscular walls of these tubes—*i.e.* there is exaggerated dilatation as well as exaggerated contraction during the exaggerated inspiratory and expiratory efforts (Watson Williams).

(5) There is spasm of the muscles of respiration.

(6) There is, specially, spasm of the diaphragm.

Having enumerated these, we are reminded of Goethe's aphorism that a man is more apt to be right in what he affirms and wrong in what he denies. Nearly all have some basis in clinical facts, though exaggerated inferences and still more exaggerated denials have been based on them.

First, however, we must view all theories in the light of Brüning's observations, by bronchoscopy on normal patients. Briefly they are: (1) when there is sudden expiratory pressure, as in coughing, there is momentary reduction of the lumina of the trachea and visible bronchi; (2) calm breathing proceeds along the same lines, but in adults, owing to the slight degree of difference in pressure, there is no respiratory modification of lumen in the trachea and visible bronchi: "even when breathing is rendered difficult through stenosis of larynx or trachea, a condition which would imply greater variations of lumen is not produced"; (3) "in children owing to the pliancy of the walls, respiratory changes of lumen are much more marked than in adults, so that in the case of strong expiratory efforts a complete closure of trachea and main bronchi takes place, and is accompanied by a cough-like noise. In the case of small children, even when breathing calmly, considerable respiratory changes of lumen may not infrequently be met with." In adults such pliancy still exists in the minute bronchi invisible to any endoscope, "bronchi which have no cartilage and whose lumen does not exceed 1 mm." "As a matter of fact, in curarised animals with artificial respiration, the measured frictional resistance of the atmosphere increases when bronchial irritants (gases or steam) are present, which can only be explained as the result of the contraction of the circular muscles of the smaller bronchi and bronchioles."[1]

Now in asthma what are the facts for which we have to account? Apyretic dyspnœa, both arising and passing off more or less suddenly; whistling rales, which sometimes appear and disappear more or less whimsically in different parts of the lungs, but usually lingering some time after the dyspnœa has gone; these, too, disappear, leaving a normal lung. But we must remember from the previous chapter that asthma is a much wider entity than this typical form of it; that it shades into the apyretic bronchitis of children and acute pulmonary oedema of the adult, into laryngismus stridulus and "angio-neurotic" oedema of the larynx. Working from this basis we see that spasm of the respiratory muscles may be at once put out of court as a sufficient genesis of the symptoms. Similarly we may put aside spasm of the diaphragm; as Wilson Fox points out, the known symptoms of spasm of the diaphragm are not those of asthma. No doubt there are extraordinary actions of the respiratory muscles during asthma (witness the wide abduction of the vocal cords even during expiration); but how are we thus to account for the intrabronchial phenomena? In relation to the diaphragm, however, there are some points worth note. In an asthmatic, and even in an asthmatic who is fairly rid of his asthma, a hearty fit of laughter will sometimes provoke an attack; and the diaphragm has been called the laughing muscle—*e.g.* the boy mentioned on p. 33 had no asthma for months except after a fit of laughter.

---

[1] Brüning's "Direct Laryngoscopy," Howarth's trans., pp. 145, 150.

If we accept the spasmodic theory of asthma—and this clinical fact alone seems to me to suffice to compel such acceptance—this could be quite accounted for as a reflex action conveyed through the pneumogastric to the bronchial circular muscles already hyperexcitable by the toxæmia and probably hypertrophied by previous attacks.

Hemispasm of the diaphragm has been described as occurring during asthma, and as half the diaphragm has been revealed by the X-rays to be motionless in some rare cases, this seems to lend colour to the diaphragmatic theory. Naturally, one is inclined to be sceptical as to the accuracy of such observations; but during recent years I have been struck by the fact that, every now and then, one sees an asthmatic where the symptoms are mainly in one lung. On investigation I found a history of an antecedent pneumonia, or a concurrent but concealed phthisis on that side, and, still more interesting, an ipsolateral lesion in the nose, causing that nostril to be more or less blocked. As to this last, I was chary of regarding it as more than a coincidence, but have noticed it in a number of cases, and, as it is in line with Brodie and Dixon's experiments, I am inclined to regard the nexus as a real one, a nervous reflex. The facts just stated, however, clearly point to the pulmonary lesion being primary, the diaphragmatic condition secondary, and not vice versa.

The theory of bronchial spasm was first put forward by Reisseissen on discovering the circular fibres of the bronchi and bronchioles, and Gairdner and Hyde Salter became strenuous advocates of this view. In support, Salter advanced these reasons: the sudden appearance of intense dyspnœa, its sudden cessation without a trace left in the lungs; the feeling of "tightness" in the chest, as if the air was locked up and could get neither in nor out; the musical character of the rales, such as would be produced by constriction in a tube, the whimsical transference of these sounds from part to part of the lungs; the relief of the dyspnœa by nervous depressants—all point to spasm. That these reasons cannot be met by any theory of merely inflammatory swelling is, as Salter says, obvious. He emphasises the obviously constrictive function of the circular muscle of the bronchi, and holds that in asthma this becomes exaggerated. Since his day, the argument has received support from much experimental research. Brodie and Dixon, for instance, showed that stimulation of the nasal mucous membrane, as also of the distal end of the cut vagus, profoundly affects respiratory movement and volume through constriction of the bronchioles. I showed twelve years ago that the application of cocain and suprarenal extract to the nasal mucous membrane will sometimes promptly relieve an attack of asthma, with disappearance of sibilus, and of the signs of pulmonary distension. (I have already referred to so-called hemispasm of the diaphragm and ipsolateral nasal disease.) How can these things be explained except as spasm and the relief of it? This effect of cocain and adrenalin seems too rapid to be explained by absorption into the general circulation, but is due to the removal of impulses from the respiratory orifice, the most sensitive part of the respiratory tract.[1] And how except by bronchiolar spasm can we explain those sudden attacks in persons with an idiosyncrasy to pollen and certain emanations, such as those from cats, horses, sulphur? Obstruction of the finer tubes by the peculiar, viscid sputum of asthma will not account for such phenomena, nor will it account for the asthma induced by a fit of laughter. Finally, we recall the exaggerated knee-jerks of the asthmatic; the fact of laryngismus which, as I have said, is essentially asthma of the larynx brought about by the same toxæmia as produces asthma; and also the statement that electrical stimulation of the intestine causes increased production of mucus (Hertz).

---

[1] See also p. 26.

With such a spasmodic obstruction there should be difficulty both on inspiration and expiration. But it is held by some that asthmatic dyspnœa is mainly expiratory, and yet there is over-distension of the lungs. If the spasm is continuous, and if, as some allege, the expiratory force is greater than the inspiratory, then we should expect pulmonary collapse rather than distension. Hence Watson Williams says that the asthmatic spasm is essentially an exaggeration of the normal rhythmical respiratory movement of the bronchial tubes—dilatation during inspiration, contraction during expiration. In this way he would explain the over-distension, and the difficulty of expiration, but on this certain criticisms must be passed.

It is a mistake to say that the respiratory difficulty of asthmatics is mainly expiratory. As previously stated, if you systematically ask asthmatics whether their greater difficulty is inspiratory or expiratory, the majority will say inspiratory, some will say both, others expiratory (see p. 13). Expiration is doubtless prolonged in all, showing the difficulty of getting air out; inspiration into an already distended lung would necessarily be difficult, but there is good reason for thinking that spasm exists both during inspiration and expiration. Brodie and Dixon found that when experimentally, by stimulation of vagus or of nasal septum, they produced bronchial spasm and continued artificial respiration, the lung immediately distended; they hold that the deflating force is not so strong as the inflating. The fact of this spasm and the correlated lung distension there is no getting past ; also it seems clear that the spasm is continuous, however we may explain the distension. Now there are two seemingly contradictory statements as to the expiratory and inspiratory forces. Campbell, after stating the figures for each in mm. Hg., says : " It will thus be seen, as John Hutchinson long ago pointed out, that the expiratory force is about one-third greater than the inspiratory. This difference is not due to a corresponding difference in the strength of the expiratory and inspiratory muscles, but to the fact that the latter have to overcome pulmonary suction, the elasticity of the thoracic walls, and the weight of the thorax—all of which aid the respiratory muscles in the act of expiration." He is careful to add that " inspiratory and expiratory force do not respectively represent the strength of the inspiratory and expiratory muscles. It has been even contended that the inspiratory muscles are the stronger, though I am not aware that this is capable of proof. They are the more constantly in action, and from the respiratory point of view the more important, seeing that expiration can take place without muscle action, while inspiration is wholly dependent upon it." He also remarks, quite justly, that while the expiratory muscles, which consist chiefly of the great abdominal muscles, are very powerful, " their great strength is not primarily for the purpose of extraordinary expiration."

Brodie and Dixon, on the other hand, say : " Under normal conditions the force of inspiration is much greater than that of expiration, and acts to better advantage. By violent respiratory movements it is possible to increase the force both of inspiration and expiration very greatly. But the mechanics of the thorax permits a more marked increase of the power of inspiration than that of expiration; the thorax is an inspiratory mechanism rather than an expiratory. Consequently, with normal respiration, marked constriction of the bronchioles is followed by overdistension. But in asthma, and in the asthmatic attack produced by muscarine, there is a yet more vital point to be observed. In both instances the effort is inspiratory." Now the reconciliation of these two contradictory positions seems to be, at least so far as asthma is concerned, as follows. Even though we accept the newer views on respiration, so excellently summarised by Arthur Keith in "Further Advances in Physiology," and admit that expiration is more largely a muscular act than we had been taught, the fact remains, that inspiration is altogether active and muscular, expiration is mainly passive, and largely the result of the powerful elasticity of the lung tissue, and of the elastic recoil of the ribs, and of gravity. The natural inference of this is that normally the inspiratory muscles are more powerful than the expiratory muscles, *qua* respiration.

Therefore in the extremely forced respiration of asthma, the inspiratory muscles will have the greater advantage, and tend to cause lung distension the moment bronchiole constriction arises. Further, as Keith points out," it is not the alveoli but the infundibula that should be regarded as the essential expansile part of the lung"; and the bronchial musculature regulates the tension of the infundibular air. But the infundibula are conical, tapering toward the bronchioles rather than towards the periphery, so that if the bronchioles are constricted, air, though with greater difficulty than normally, will enter owing to the negative pressure caused by the inspiratory movement of the thorax. But the expiratory pressure is exerted on the slender walls of alveoli and infundibula and with the resistance ahead in the tapering infundibula and constricted bronchioles, this pressure acts at a disadvantage as compared with inspiration. Hence, though expiration is for this very reason prolonged, distension will result.

One other point in favour of bronchial spasm as explaining the dyspnœa of asthma is to be found in Keith's statement: "The bronchial musculature may regulate the distribution of air and blood throughout the lung." Now the shifting about of sibilant areas during an asthmatic attack has struck most observers, and can be explained in this way, though it could also be explained as Berkart would explain it, by a plug of the tough secretion being retained here and expelled there.

The lung distension during the asthmatic spasm, then, is to be explained by the facts that, whatever be the relative value of the inspiratory and expiratory forces during quiet respiration, during asthma respiration is altogether abnormal, is a concentrated muscular effort in which inspiration, normally muscular, has the advantage over expiration; that this advantage is enormously increased by the constriction of the bronchioles, the conical form of the infundibula and the delicate alveolar tissue, and the resulting disadvantage at which the expiratory force stands relatively to the inspiratory.

But bronchiole spasm is by no means the whole story of the asthmatic dyspnœa. I have been careful in the above argument to say bronchiole constriction. Bronchiole spasm is beyond doubt; equally beyond doubt is the presence of a vascular element, a turgescence, in many if not in the majority of cases of asthma. The injected condition of the tracheal mucosa during asthma I have already mentioned, and this is bound to extend lower down into the bronchi. It is fair criticism to say that this may be the result, not the cause, of the dyspnœa and coughing; but as we have seen in preceding chapters, even in typical asthma, there are vascular phenomena (urticaria, erythema, petechiæ, Raynaud's symptoms) and the symptoms are more like catarrh, and less like spasm in atypical asthma—the apyretic recurrent bronchitis of children, which is admittedly asthma, the paroxysmal pulmonary oedema of the adult which may alternate with it. Laryngismus stridulus, we have seen, shades into laryngitis stridulosa, and in the next chapter we shall see that paroxysmal sneezing and rhinitis are largely due to the same toxæmic conditions that produce asthma. So struck was Gee by "the catarrh which manifestly attends most, if not all, asthmatic seizures" that he relegated spasm to quite a subordinate position and adopted the hypothesis of "pneumonic asthma." Asthmatic attacks often end with profuse expectoration. If toxæmia result in spasm of the bronchial tubes, why should it not also result in spasm of the bronchial arteries which, coming from the systemic circulation, ramify to the uttermost bronchioles and are under vasomotor control? Why should there not result here the same peculiar vascular condition as in the urticaria, which so often besets the skin of asthmatics? We may still ask the same question if we adopt recent views as to urticaria being a direct action of toxin on vessel wall.

Halsted reports the case of a young girl of 15, with typical attacks of suddenly arising bronchial dyspnœa often seemingly about to be fatal, and occurring at intervals for ten years; in her the bronchoscope revealed "a perfectly apparent swollen, pale and oedematous condition of the whole mucous membrane. It was a case of angio-neurotic oedema of the bronchus."

The fact is that artificial distinctions have blinded us to the proper scientific grouping of morbid conditions that have a common basis. Catarrhal conditions of the mucous membrane result not only from external irritants and microbic invasion, but also from irritants, toxins, acting from within. These toxins act in different ways in different people, and in the same people at different times. In children we get laryngismus, croupous laryngitis, recurrent bronchitis, typical asthma; in adults the chronic "bronchitic" wheeze of the obese or regular asthma, angio-neurotic oedema or acute pulmonary oedema. Generally speaking, it may be said that the catarrhal conditions represent less profound toxæmia than the spasmodic, and are therefore usually antecedent to the spasmodic. The catarrhal condition thus set up renders the mucous membrane more vulnerable to cold and microbic infection. Contrariwise, a catarrh of external origin will more readily affect the bronchial membrane of the asthmatic, and induce

Important

spasm. The nervous system of the asthmatic suffers, as we have seen, not only in the respiratory tract, but elsewhere ; but there, spasm becomes readily induced in connection with the hyperæmic, irritable condition of the mucous membrane. The secretion varies with the special form which this hyperæmia takes, depending on the idiosyncrasy of the patient and the nature of the toxin. That all this is true is shown by the fact that the treatment of all these conditions is much the same, and, no matter how acute or how chronic they be, is always more or less effective. If further proof be needed, it is that in an asthmatic an ordinary bronchitis of genuine nature will evoke an attack of asthma, but when you rid him of his toxæmia he may have an attack of bronchitis without asthma ; this I have often seen.

To summarise. The asthmatic paroxysm involves bronchiole spasm and a hyperæmia of the mucous membrane. Both result from toxæmia. This hyperæmic condition may vary from that of the recurrent "bronchitis" of children to "angioneurotic" oedema and acute pulmonary oedema, according to the nature and amount of the toxæmia. It may, especially in children, long precede the onset of typical spasm.

The above is largely a repetition of views expressed in my paper of 1900.

CHAPTER VII

THE NOSE IN RELATION TO ASTHMA

THE importance of a nasal factor in asthma—almost unknown to Salter, who cursorily mentions sneezing—was first recognised by Herck of Freiburg in 1844, and revived by Voltolini in 1872, who claimed to have relieved eleven cases of asthma by the removal of nasal polypi. This idea received further impetus when Lazarus, Brodie and Dixon and others showed that electrical stimulation of the nasal mucosa caused bronchial spasm, and more especially when the disease became almost universally regarded as a neurosis. Almost everyone kept gazing at the spasm and tinkering at the nose. I have seen patients with noses absolutely ruined, mere shells of what they should have been—their asthma remaining the same, but promptly clearing up on simple antitoxæmic treatment, except in the case of a poor woman who owed an opium habit to her doctor. Francis cauterises the septal tubercle of all asthmatics—sometimes a valuable temporary procedure; others would also cauterise the lower turbinals—an unnecessary addition. The value of proper nasal treatment cannot be gainsaid; but that it should be subsidiary and ancillary to treatment of the toxæmia I have, where mouth breathing was absent, occasionally and successfully proved by the experiment of carrying out the latter treatment and leaving the nose alone. Apart from the experimental and therapeutical evidence just mentioned, the importance of a nasal factor in asthma can be gauged from several considerations.

I quote again from my previous paper: " The true respiratory orifice, the orifice of the respiratory cavity, is the nose. Like other orifices, it is the most sensitive area of, and when diseased is liable to set up spasm in, its correlated viscus (*cf.* irritation at neck of bladder, fissure of anus). Its widespread connections are illustrated by the analogy which Gowers has pointed out between a spasm of sneezing and tetanus. Both involve contraction of muscles in head, neck, trunk and limbs. The nasal mucous membrane derives general sensation through the fifth nerve, which is also its vasomotor nerve ; it is largely a specialised erectile tissue requiring constant vasomotor control. As Bosworth says: " The nasal passages contain an exceedingly important, perhaps the most important, and certainly the most intricate apparatus connected with the function of respiration, of the whole respiratory tract, and one on whose normal functional activity depends the integrity of the whole of the mucous membrane of the respiratory tract below."

Not only does the nose purify the inspired air, but it supplies, or should supply, most of the moisture and heat of the expired air, the function of the lungs being the interchange of gases, and not the heating or moistening of them. Hence nasal disease is apt to be associated with asthma in three ways: (1) Reflexly, through the nervous sytem. The sensitive respiratory orifice is bound to send impulses to all parts of the respiratory tract. (2) Where the nasal disease is obstructive, the onus of warming, moistening and purifying the inspired air is thrown on the bronchi and lungs, which are thus being constantly irritated and made liable to more or less chronic inflammation. (3) A diseased area is always a nidus or focus of inflammation, liable to attract disease to itself and to spread it elsewhere.

These physiological and pathological considerations cannot be too much emphasised, and are supported clinically and statistically. Clinically, by the fact that sneezing then wheezing form a routine sequence in many asthmatics; my records give 15 per cent., probably a low figure. Lublinski (quoted by Goodhart and Spriggs) gives the percentage of nasal lesions in asthma as 29, Francis 14; my own series of 200 cases yields a percentage of 77. This higher figure I take to be nearer the truth, and while it emphasises the importance of nasal disease or defect as a factor in asthma and one that cannot be neglected in treatment, the basal factor is the toxæmia, which is always present. Purely nasal treatment will succeed only where the toxæmia is slight, or only temporarily in more severe cases. Another way of stating the same thing is that asthmatics form a small minority of patients suffering from nasal disease. My own statistics are useless in this respect, for I see an unduly large proportion of asthmatics, but Goodhart and Spriggs give the figure as 7·5 per cent.

Of course, all this raises the question as to what is a normal nose; but I have been surprised on going over the case records to find how decided were the conditions demanding treatment. Adenoids, sinusitis, polypi, turbinal hypertrophies, septal deviations and spurs cannot be regarded as negligible. A nose ought to be such that turbinal structures do not touch the septum,[1] so as not only to secure a free air-way, but to prevent the incessant transmission of impulses from an abnormally sensitive nose to the bronchial tree. Otherwise a nose is not normal. It is almost impossible to cure an asthmatic mouth-breather; for cold, foul, unmoistened air perpetuates bronchial irritation. Not only are the conditions that cause mouth-breathing apt to prevent due oxidation of the tissues; but intestinal toxæmia and the imperfect oxidation of the tissues and of the food by the tissues which characterise the asthmatic, react on the nose.

Outdoor exercise is of supreme value to the whole metabolism of the asthmatic, and in a paper published in 1910 I showed the importance of exercise to turbinal tone. Sitting in a stuffy room will in many people cause nose-block from fullness of the turbinals; a walk will contract them; a smart sprint will draw them tight to the bone as if by adrenalin. An asthmatic nurse regularly got nose-block and nasal catarrh, and would be threatened with asthma, when sitting in a warm room; she would go out on her bicycle and get rid of these symptoms. In short, the same thing which procures active oxidation in the tissues, especially in the muscles, procures a freer air-way in the nose.

---

[1] An exception to this must be made in the case of children. In them the middle turbinals commonly touch the septum. This is related to the development of the accessory sinuses. Only the antrum is of any size in children, and the air-path in children does not rise higher than the orifice of the antrum, which is thus ventilated.

Conversely, the same toxæmic conditions which set up bronchial catarrh and spasm, cause nasal catarrh and paroxysmal sneezing. Where turbinal enlargement is thus brought about, first oedema and then polypi are apt to result if the relative position of the middle turbinals to the septum is such as to induce pressure. Probably when, in children who have no nasal suppuration, polypi are found, they arise in this way (*cf.* the asthmatic family mentioned on p. 64; they were reared on slops, most had asthma, two had also polypi).

Do the enlarged tonsils and adenoids, so common in such children, arise also from the effects of evil feeding and hothouse rearing? The boy mentioned on p. 33, who got rid of eczema and asthma by careful diet and Spartan regime, had, after reverting to carbohydrate excess, not only recurrence of asthma and eczema, but developed chronic rhinitis and enlargement of tonsils and adenoids. Eczema is common in these children with tonsillar and adenoid hypertrophy. The question of the relation of this common affection of children to diet and defective tissue oxidation needs working out, but after long observation I am inclined to think the nexus is a real one. The vicious feeding on slops and sweets leads both to a toxæmic condition with enfeebled resistance and to caries of the teeth, the latter increasing the septicity of the mouth. This aggravates the tonsillar condition; mouth-breathing with ill-developed nose and imperfect oxidation follows, and so the vicious circle runs round. At any rate, if the ingenuity now devoted to enucleating tonsils were devoted to the investigation of this question, and to preventing the excuse for the present surgical ferocity, it would be much more creditable to our profession.

Percepied, in a recent paper on the spasmodic coryzas says: "Aperiodic spasmodic coryza, hay catarrh, asthma, are only various expressions of the widespread affection causing vasomotor spasm, and secretory disturbance of the aerial tree. The name changes according to the anatomical area involved or according to the exciting cause; but it is an error to consider such manifestation as a separate entity." Percepied identifies "hyperæsthetic rhinitis" with asthma. One can readily understand, therefore, how things which are innocuous to others become to asthmatics intense nasal irritants, and provoke spasm. Dust, flour, the fluff off bedding, sulphur, pollen, the emanations from animals, such as cats and horses, are known to provoke asthma. Now, while in some of these patients are found marked nasal abnormalities, such as polypi, turbinal excess and so on, in others they are absent, and even no hyperæsthetic area may be found with a probe. In some patients the irritability is limited to some specific irritant; others, in whom dust will cause paroxysmal sneezing and asthma, will have no hay fever; some who have hay fever will be immune to roses, which are harmful to others. We are thus face to face with the question of hay fever. Only its relationship with asthma will be considered here; the disease has been recently fully discussed by the late Dr Eugene S. Yonge, in his excellent book, "Hay Fever and Paroxysmal Sneezing."

Are hay fever and asthma identical, as commonly stated? In other words, have they the same toxæmic basis? From personal observations I am not able to give a decided answer to this question; for these reasons. Pure hay fever is a seasonal disease, confined to the early summer, when certain grasses and flowers are in bloom; the subjects of it suffer for only about six weeks in the year, and while it is sometimes difficult to get asthmatics to submit to a prolonged and careful, if not very severe, regimen for a disease that may occur at any time, it is immensely more difficult in the case of a disease that is usually only partially disabling, and that for about six weeks. To be effective such a regimen would require to be carried out for a few months before the expected attack, and I have never been able to get a patient to submit to this. Before discussing the arguments for and against the identity of the two diseases, let me set down certain facts from my own observation.

A patient with hay fever may be cured of it by purely nasal treatment, as asthmatics often temporarily, but rarely permanently, are. This occurred in the case of a man of 30 who has, after purely nasal treatment, remained free of hay fever for twelve years, and that although his father had both hay fever and asthma. Again, a patient with both diseases may get rid of hay fever by purely nasal treatment, be left with asthma, and get rid also of this by antitoxæmic treatment. A lady who had hay fever twelve years, and asthma for nine, had had her septum resected a year before coming to me.

She had no more hay fever, but still had asthma. There was a large perforation in the septum, rendered vaster by the necessary removal of a piece of necrosing vomer. On antitoxæmic treatment she gradually got well and has remained free of asthma for more than a year. An almost identical history was noted in the case of a lady who was cured of her hay fever by nasal operation, four years before she came to me on account of asthma which promptly improved under constitutional treatment, and which, I believe, has now disappeared.

Asthmatics who suffer from hay fever nearly always require nasal treatment, so that while the father of the man above-mentioned got rid of both diseases simultaneously, under combined treatment, I have never seen a combined case treated on purely antitoxæmic lines. Such a case so treated, with resulting cure of asthma but not of hay fever, would go far to disprove the identity of the diseases; and I may recall the fact that I have seen a patient cured of asthma by antitoxæmic treatment without the nasal disease being touched.

In only one other of my cases of combined hay fever and asthma was treatment at all faithfully carried out. I first saw her in 1900, when she was 22. She worked as a tailor, had typical week-end asthma, except for special paroxysms in the hay season or at menstrual times. Her nose was treated, with decided improvement on the asthma; but it was not till she ceased work in 1904, and altered her manner of life, that she became free of asthma and hay fever and remained so for nearly eight years. She had a hard life, and became rather lax in her regimen with recurrence of the combined diseases; she took herself in hand as to regime and had her septum resected and again got rid of the asthma and hay fever. Though not quite conclusive, this case is highly suggestive of the same toxæmic basis for both asthma and hay fever. Both disappeared together, both recurred together, and although nasal treatment was necessary twice over the constitutional treatment was even more important than the nasal.

That hay fever has a toxæmic basis closely allied to asthma is further suggested by the following considerations. We have seen the close connection between asthma, eczema, uric acid and urticaria. I quote the following from Percepied. From investigation of the heredity of 53 cases of hay fever he compiles this table:—

	Hay Fever	Asthma	Eczema	Gout
Father . . .	3	10	3	1
Mother . . .	3	4	2	1
Grandparents . .	—	8	1	1
Brother, Sister .	1	3	—	—
Children . . .	1	—	2	—
Collaterals . .	2	2	—	—
	10	27	8	3

> "Six patients had eczema, one prurigo, one gout. Out of 107 hay fever patients, a family history of asthma was found 47 times. Our statistics approach those of Sajous, who found a hereditary history of hay fever in 35 per cent., of asthma in 42 per cent. One thus sees how frequently occurs the connection, substitution or alternation of these diverse manifestations of the same malady, paroxysmal sneezing, hay fever, asthma, eczema, gout. We have also frequently found the urticaria, so carefully noted by Rapin of Geneva."

Yonge also draws attention to the frequent connection of hay fever with gout, uric acid excess and urticaria, and quotes Wolff's observations as to the presence of eosinophilia during the attacks, its absence in the intervals.

He, further, goes the length of saying in a footnote:

> "Certain patients cease to suffer from hay fever without any apparent reason; and conversely the malady may begin at various ages or even comparatively late in life, also without apparent reason. The writer considers that the supervention or the abrogation, respectively, of certain faults of metabolism would be a feasible explanation of these various phenomena; but unfortunately the phrase, as it stands, does not connote anything sufficiently definite to admit of proof or disproof."

There is thus much evidence to suggest for hay fever a toxæmic basis kindred to that of asthma; there are also considerations which suggest a specific difference; as follows:—

(1) The majority of asthmatics have no hay fever; the majority of hay fever patients have no asthma. My own record of asthmatics yields 7 per cent. with hay fever.

(2) Hay fever is a seasonal disease, asthma is not; asthma has a marked nocturnal periodicity, hay fever paroxysms appear during the day and tend to disappear at night. These differences, however, are merely connected with the times of prevalence of, or exposure to, the irritating pollen in the atmosphere. In line with these facts is the other that the sea voyage which is an invariable cure for hay fever because of the absence of pollen is often bad for asthma because of the overfeeding and under-exercise involved.

(3) A patient with the double disease may get rid of his hay fever and retain his asthma.

(4) Hay fever is stated to be characteristically

an affection of the educated classes (Yonge); asthma is very common among working folk. While this statement as to hay fever is probably in the main true, it is less so than at first sight appears; for careful inquiry among the working classes reveals the fact that some of them, at least, have hay fever without thinking much about it, and, especially if it complicates asthma, without realising what it is. The comparative prevalence of hay fever among the educated classes is probably related to their generally increased susceptibility to nervous impressions and diminished resistance to pain; possibly also to their increased liability to form toxins owing to the defective metabolism connected with indoor life and insufficient muscular exercise.

(5) Perhaps the most striking argument for considering hay fever specifically distinct from asthma is that many asthmatics have paroxysmal sneezing without ever having hay fever. This is obvious from the percentages of the two affections in asthmatics I have already given; 15 for paroxysmal sneezing, 7 for hay fever. Morell Mackenzie reported a case of intense nasal hyperæsthesia and paroxysmal sneezing without hay fever; the following case is quite as remarkable:—

> A lady of 29 came to me over a year ago with a history of repeated asthma since she was two years old. Two sisters, a brother, two children of one sister, her father who is a doctor (and doctors are rather prone to hay fever), all have asthma and sneezing; none has had hay fever. She herself has had no asthma since the first six weeks of treatment; the others I have not seen.

Such cases rather suggest that not only is there a specific irritant, but also (if one may coin a word) a specific irritand in hay fever—*i.e.* a specific soil which reacts to the specific irritant.

(6) Dunbar found in grass pollen a toxic substance which, applied to susceptible persons, developed the symptoms of hay fever, and by injecting which into animals he obtained a more or less antidotal body, pollantin. This body is said not to be a true antitoxin, as the noxious body is said not to be a true toxin ; nevertheless Yonge says that after the use of pollantin "60 per cent. of cases experience relief, 30 per cent. partial relief, and the remainder no relief."

To sum up. There is a toxæmic basis for hay fever kindred to that of asthma ; it seems to be slightly different, favouring the irritant action of certain pollens in the nose and the production of coryza rather than of bronchial spasm, though that also is produced in many cases. (It must be remembered that pollen grains, of which the average size Morell Mackenzie puts at $\frac{1}{10}$ of a blood corpuscle, could easily find their way to the smaller bronchi and there induce spasm in predisposed persons.) The toxæmia is the predisposing cause of hay fever, the pollen the exciting cause ; or, put otherwise, the toxæmia is the basal factor, the pollen the nasal factor.

What has been said hitherto refers to the effects of grass pollens ; but those of roses, and, especially in America, of ragweed and golden rod, produce similar effects, frequently *plus* asthma. Hence not only is there a difference in the seasonal developments of these affections, but locality becomes prominent in relation to the special irritant. Certain places, as being prone to induce asthma, are dreaded by asthmatics with specially irritable respiratory tracts.

For instance, around Stuttgart many persons are subject to a coryza indistinguishable from hay fever, but caused by the stellate hairs or spikes from the back of the plane-tree leaves (Yonge, p. 53). And obviously there must be many unknown microscopic irritants to which many asthmatics are specially prone to succumb.

We can thus to some extent account for what is called place-asthma. Certain asthmatics find they are free of attacks in one place, and get them in another where other patients seem immune. But in such cases there are, besides atmospheric irritants, other factors frequently in play.

(1) Change of place often involves material change of regimen. A patient asked me why he was free of asthma during a short stay at Madeira but had it on board ship, was free for weeks while working hard at home, but got it during a week-end in the Highlands; forgetful of the fact that, while in Madeira, as at home, he was having vigorous exercise, whereas on ship, as in the Highlands, he was loafing and overfeeding. Many patients delude themselves in this way as to place-asthma. A lad who had in his earlier years suffered from inveterate asthma owing to injudicious coddling used to differentiate between places in their effect on him. He went to British Columbia and for the first time in his life "endured hardness." His asthma left him. Recently, being down on his luck, he went to Vancouver and had an exceptionally good feed, so that the waiter remarked on his appetite. He had an attack of asthma, and

wrote home that Vancouver did not agree with him !

(2) As in the case just instanced the psychic factor counts for something. This has been shown more strikingly, perhaps, in relation to hay fever patients ; cases are quoted of patients having a violent attack when shown artificial roses which they supposed to be real. Saenger has lately over-emphasised this factor in relation to asthma. But there is no doubt that the dread which patients have as to certain places adversely influences their metabolism, and renders them more liable to attacks.

(3) Damp localities are certainly bad for asthmatics, because damp, especially a damp soil, seriously interferes with the tissue oxidation. Of all the factors which tend to induce "place-asthma" this is the only one of real consequence ; I have never yet seen a patient carry out treatment thoroughly who could not go anywhere, and remain free of asthma, or at least as free as he was at home,[1] provided the place was not too damp. British Guiana, for instance, parts of which are below sea-level, is not a place to risk sending any asthmatic.

As for asthma caused by animal emanations, cat-asthma, horse-asthma, I have never seen such cases. Of the nature of such emanations, as of the constitution of odours, we know nothing, aside from a psychical factor. It is conceivable that asthmatics, hypersensitive to the finest dust, such as lycopodium powder and pollen, may also respond to those finer emanations which are imperceptible to our normal selves. Of colour blindness and music deafness and their opposites we know a very little ; of nasal acuity we know less than the dogs.

---

[1] This qualification may seem a large one ; that it is not will appear later.

The relation of nasal disease to asthma may be summed up in this way. Toxæmia alters the asthmatic so that his condition becomes like a powder magazine ; nasal disease is apt to supply sparks which cause the explosions of asthma.

CHAPTER VIII

ETIOLOGY

THE purpose of this chapter is threefold: to summarise the evidence scattered through the preceding chapters for the toxæmic basis of asthma; to indicate the possible nature of the toxæmia; to mention certain conditions initiative of altered metabolism, and therefore of toxæmia.

The last first. Naturally, HEREDITY has been emphasised by most writers as predisposing to asthma; but while it counts for much, experience has taught me that upbringing, especially diet, counts for more, so much more that I regret I have rather neglected systematic record of the element of heredity in my notes, and cannot give a reliable statistic. Moreover, these two things, heredity and upbringing, are so much entangled with each other that an element of doubt must hang over all figures given on this head, especially those of the older writers, Salter, for instance, gives 38 per cent. as showing a hereditary tendency; but says on the next page it is a curious fact " that several brothers and sisters in a family may be asthmatic, without the parents having been so. This would seem to suggest, in respect to disease, a principle with which breeders of cattle are familiar—that certain combinations produce certain results, and lead to the creation of certain peculiarities." The more probable reason is that, as in the case mentioned on p. 64, the children were all brought up on pap and coddled into disease—oxypathy, to use Stoeltzner's word. For heredity 38 per cent. is certainly too high a figure; I should put it, from examination of my own records, as between 10 and 20 per cent.; Berkart gives 16 per cent., Goodhart and Spriggs 21 per cent. There is no doubt of a strong hereditary tendency in certain cases, as with gout, as in the case of the child mentioned on p. 33; he was 2½, had had asthma two years, and had a maternal aunt with eczema in childhood, asthma in adult life; a paternal aunt with a like history; a history of gout on his mother's side. Anaphylaxis to eggs often characterises asthmatics, and is inherited, not acquired; their anaphylaxis to horse-serum likewise. This is another way of saying that some patients are born with certain idiosyncrasies, certain bio-chemical tendencies, in virtue of which they exhibit varying degrees of difficulty in metabolism, especially nitrogenous metabolism. Some asthmatics are less sensitive in this way; but in asthmatics generally there is deficient nitrogenous metabolism, especially in the presence of carbohydrate excess. It must be emphasised that asthma is more made than inherited.

This statement is further borne out by the AGE incidence. The following table is calculated from 168 cases of which I have notes as to when symptoms began, and is placed for comparison alongside Hyde Salter's, calculated from 225 cases:—

		H. S.	J. A.
Up to 10 years	.	31·6 per cent.	30 per cent
10 to 20 ,,	.	13·3 ,,	10 ,,
20 to 30 ,,	.	17·6 ,,	26 ,,
30 to 40 ,,	.	19·6 ,,	18 ,,
40 to 50 ,,	.	10·7 ,,	8 ,,
50 to 70 ,,	.	7·1 ,,	8 ,,
70 to 80 ,,	.	0·4 ,,	—

We thus see that the highest decade incidence, amounting to nearly a third of the whole, is in the first ten years of life, when pap feeding and excess of carbohydrate food is most telling in the way of producing that " bronchitis " of children which leads to coddling and confinement indoors and so to further defective oxidation. And thus the vicious circle goes round. That this is not a fanciful explanation is borne out by a study of the clinical histories and by recalling the fact that we found these same conditions productive of that other " spasmodic " ailment of children, laryngismus. And although heredity is a distinct factor in this decade the percentage (30) for the decade is nearly twice that of the heredity percentage (16, if we accept Berkart's figure as a mean). Further, the percentage for this decade is thrice that of the next, and that is still a decade in which certain inherited diseases and tendencies are very prone to turn up—*e.g.* the peg teeth and internal ear deafness of syphilis. Lastly, rickets, which is associated with asthma in children, though not to the extent Berkart holds, is a disease of malnutrition, and is not hereditary. According to the tables given above, the third and fourth decades are, next to the first, the most prone to asthma. Apart from dietetic errors the case histories afford some explanation for this. Four infectious diseases specially affect the respiratory tract: measles, whooping-cough, influenza, pneumonia. Measles tells most in the first decade, and there is no doubt it will aid for the worse the other factors above-mentioned. Whooping-cough tells in the first and second decades, and to it some patients attribute the start of their asthma; but a much larger number blame influenza and pneumonia. It is striking how many trace their asthmatic woes to influenza; and influenza and pneumonia are more apt to assert themselves in the third and fourth decades than in the first. Not only do these infections attack the respiratory tract, but what we now know of immunity leads us to explain their after-effects, not by an altered nervous system but by a subtle alteration of all the tissues. The chemical response of the tissues whereby they become immune to infections is an adaptation of their food-assimilating powers. Hence we can understand how such infections tend to evoke asthma, which is a disease of nutrition. One other condition powerfully affecting metabolism becomes operative in these second and third decades—pregnancy, with its sequence of parturition and lactation. Several cases clearly trace the beginning of their asthma to this. This seems at first sight borne out by an analysis of the sex incidence relatively to the decades in which asthma started. All authorities find it more frequent in males than in females, though I do not find the proportion anything so great as that of Hyde Salter, 2:1. The ratio of males and females may be conveniently stated thus: Hyde Salter, 7:3·5; Goodhart and Spriggs, 7:5; myself, 7:6, nearly. The figures for the decades are given in the table:

Age at which Asthma started	Males	Females
1 to 10	35	15
10 to 20	5	6
20 to 30	15	32
30 to 40	22	14
40 to 50	3	7
50 to 60	4	3
60 to 70	6	1
	90	78

We thus see that while in the first decade the ratio of males to females is more than 2 : 1, in the third decade this ratio is reversed. This sex influence appears in the fifth decade, where the proportion of females is double that of the males; at least three out of the seven women connected the start of the asthma with the menopause. But it is easy to make too much of the influence of pregnancy and parturition; what does begin to tell more on females, especially of the working class, after the age of 25, than sexual influence is the home life. It is an indoor life with insufficient exercise, often careless dietary, and resulting constipation and intestinal putrefaction; whereas, although many of the men, especially those who carry their food to their work, are subject to the same prejudicial diet, they have more open-air exercise; and I find as the result of a long experience with working men that the age at which a large proportion begin to complain of digestive disorder is as they are approaching forty, a fact in keeping with the figures of the fourth decade as given above. (It would redound to the credit of the medical profession if it raised its voice for the one-break-a-day system on behalf of the working men of this country. It works well in America and in the few cases in this country where it has been enforced ; I have known a decided improvement in the health of the men as the result of the change ; it is more economical for the employers. The present system of starting work, often with insufficient sleep, and before breakfast, means three hurried, insufficient meals, a deteriorating digestion and wasted energy.)

We are now in a position to sum up the evidence for toxæmia as the basal factor in asthma, not forgetting that diseases of the respiratory orifice, the nose, are almost certain, sooner or later, to induce catarrhal conditions lower down, that this orifice is in its organisation the most complex part of the whole respiratory tract, and that irritation is apt to excite spasm there. We have just seen, statistically, how much there is to support the idea of toxæmia. Clinically, we have reviewed the evidence for a toxin tending to provoke catarrhal conditions of the whole respiratory tract from nose to bronchioles, as well as spasm of the smaller bronchi and bronchioles and of the blood-vessels. Such are the recurrent bronchitis of children as well as the chronic wheeze of the obese ; laryngismus and spasmodic laryngitis ; paroxysmal pulmonary oedema. Conditions of admittedly toxic origin were seen to be frequently associated with the asthmatic seizure : urticaria, Raynaud's symptom, " angio-neurotic " oedema, paroxysmal pulmonary oedema, spasmodic colitis. Many conditions allied to asthma and due to toxæmia are found in asthmatics and in their family history : rickets, gout, eczema, hay fever, paroxysmal sneezing. Periodicity, nocturnal and week-end, is found not only in asthma, but in angio-neurotic oedema, epilepsy, albuminuria, the "Monday morning disease" of horses. The urinary changes of asthma are such as to suggest toxæmia: uric acid excess, occasional increase of the ethereal sulphates, transient albuminuria. The clinching evidence for asthma being a toxæmia is, as we shall see, the therapeutic one; for, unless seriously complicated, all cases of asthma can be improved, and most of them cured, by anti-toxæmic treatment. We have seen how nature cures the asthmatic spasm by enforced starvation, and we shall find that by periodic starvation the disease itself can be cured more or less permanently. And while the asthmatic cachexia is of itself strong warrant for believing in toxæmia, this belief becomes certainty when we find that proper treatment not only rids the patient of bronchial spasm, but even before that clears up his cachexia.

Once the mucous lining of the bronchioles and smaller bronchi has been rendered irritable by the toxæmia, spasm of them will readily be induced by excitants of the vagus or of its closely related nerves, such as the fifth. Hence in such subjects irritants to ear, nose, stomach, intestine may induce asthma. We have seen that there is much evidence to suggest that the toxæmic condition in asthma arises from a perverted nitrogenous metabolism which is apt to be induced by carbohydrate excess; this is aided by the intestinal fermentation and putrefaction associated with the flatulence and constipation so frequent in asthmatics. As a matter of experience, I find it more difficult to cure asthmatics while they have flatulence; constipation is never allowed. Bouchard showed that the toxicity of the urine and fæces were to some extent parallel; that if you diminish the intestinal toxicity you also diminish that of the urine; he showed the presence of alkaloids in both. Though they arise in the normal metabolism of the tissues they arise in abnormal form and quantity in perverted metabolism. They are nitrogenous bodies. The question naturally occurs, as was suggested in my lectures, might not the toxic body in asthma be the alkaloid muscarin or something allied to it? And for these reasons. Experimentally, asthma is produced by muscarin; clinically we find that the asthmatic spasm is best antagonised by the antidote of muscarin, the alkaloid atropin; at least it has always been my stand-by, except in special circumstances, when as a matter of urgency I use adrenalin. Atropin is the essential constituent of all symptomatically successful proprietary "cures" for asthma. I believe I owe this idea as to muscarin to the work of Brodie and Dixon in 1902; though they do not suggest that this is the cause, probably because they viewed asthma as a neurosis, not as a toxæmia. They found they could induce bronchial spasm in animals with characteristic asthmatic sibilus, by intravenous injection of muscarin or by stimulation of the nasal mucosa. Further, Brunton in 1898 remarked: "Muscarin has been shown to be one of the products of decomposition of albumin, and it appears to be formed every now and then in the intestinal canal."

There are at least two probable points of origin for the asthmatic toxin : the intestine and the tissues themselves. In addition to the remark just quoted from Brunton there is other evidence for the intestine being one source of the toxin. Not only do the constipation and flatulence, so common in asthmatics, point in this direction, but so do the urticaria and erythema ; for such rashes are often produced by enemata washing toxic substances from the bowel into the circulation. The frequent excess of ethereal sulphates in the urine (pp. 56-58) and the occasional co-existence of colitis also point to an intestinal source. But while this may be the main offender in some cases, the tissues themselves, and especially the muscles, must in most cases also produce the toxin. For not only are flatulence, constipation and intestinal symptoms frequently wanting in asthma, but intestinal treatment alone is not sufficient. Asthma is closely associated with excess of food, particularly of carbohydrate food, relatively to the individual's metabolic capacity, and to the amount of his exercise. When these are properly adjusted to each other the asthma ceases in most cases. Too much carbohydrate—energy food—may interfere with due metabolism of tissue foods and of the tissues themselves, especially in the absence of sufficient muscular exercise. If the less complex carbohydrate molecule is oxidised at the expense of the more complex nucleo-proteids, these will be imperfectly metabolised and give rise to such toxins as may cause asthma. Signs suggestive of this are the uric acid excess, the transient albuminuria, the localised oedema of skin, larynx and lung. When the exercise and amount of food are properly adjusted to

Important

each other, and to the individual metabolic capacity, the asthma ceases.

We recall Bouchard's experimental observation that active open-air exercise in the country diminishes the convulsive toxins in the urine for a considerable time. Indeed, it looks as if imperfect metabolism by the voluntary muscles of excess of their ordinary food resulted in the toxin that caused spasm in the involuntary muscles. The tissue origin of the asthmatic toxin is further supported by the idiosyncrasy of many patients to eggs and horse-serum; for these albumins will produce anaphylactic reaction with asthmatic symptoms whether they be given orally or hypodermically.

Finally, it is to be remembered that it is not always a spasm-producing toxin that is evolved in these cases; the "paroxysmal" pulmonary oedema that sometimes complicates asthma, and the "Monday morning" disease of horses with its black strangury and hæmatogenous degeneration of muscle, are proof of this. The acute oedemas that may attack skin, larynx or bowel are probably to be classed here unless they prove to be the result of vascular spasm, which, in the light of recent research, is unlikely.

Lastly, as indicated in the previous chapter, the toxæmia of hay fever is one that tends to cause catarrh rather than spasm.

Postscript.—Since the bulk of this book was written my attention has been drawn to records of experimental proof of the views which are stated above and which have been deduced from the clinical and therapeutical facts—that asthma is a toxæmia. Eustis (*Amer. Jour. Med. Sc.*, June 1912, quoted in *B.M.J.*

Epit., 28th September 1912, Art 160), acting on the assumption that a definite toxin, causing bronchial spasm, similar in action to muscarin, originated in the intestinal canal, " investigated the amins formed by intestinal putrefaction of the several amino acids of normal pancreatic digestion of protein. Barger and Dale have worked out the physiological action of the several amins, and their results explain many of the symptoms observed in cases of intestinal toxæmia. Of these several amins, betaimidazolylethylamin, while having a slight action on blood pressure, has a specific action upon unstriped muscular tissue, causing contraction of the uterus and bronchioles, resulting in great dyspnœa and death in the rabbit and guinea-pig from the complete exclusion of air by the toxic spasm of the bronchioles. By injecting ½ mg. of this base intravenously or into the trachea, death results rapidly, with violent inspiratory efforts, whereas the same dose injected subcutaneously or into the peritoneum has much less toxic effect, pointing to the fact that its action is entirely local on the unstriped muscle fibre, and that the subcutaneous tissues have a detoxicating effect." (Note the insignificant action of this poison on the blood pressure, a point in harmony with the clinical records given in Chapter II.)

Even more interesting is a recent paper to which Prof. Walker Hall has kindly drawn my attention. It is by Prof. Hans H. Zeyer (*Medizinische Klinik*, 3rd November 1912, p. 1773). " Die pharmakologie des vegetativen Nervensystems." Specially interesting to me in the light of my contention that the imperfect metabolism of the proteid tissues under

Current Chemist

enzyme action, and not simply the evolution of that toxin under bacterial action in the proteid food in the bowel, is responsible for the toxin of asthma is the paragraph of which the gist is as follows. Meyer points out that the symptoms of anaphylactic shock are due to the development of powerful autonomous poisons; that among other symptoms produced is bronchial spasm; that the same symptoms can be produced by intravenous injection of the products of the peptic digestion of meat; that both poisonings can be counteracted by atropin (just as asthmatic spasm is counteracted by the same drug); that the exact nature of the poison in either case is not known, but that according to Barger and Dale both are probably identical and may be the body called histamin. These observers and Kutscher had found this body in ergot. Ackermann obtained it through bacterial action from histidin, a decomposition product of albumin. If the peptone compound is still further broken down by the action of trypsin and erepsin, there results a substance called erepton with different poisoning reactions from peptone. It is an active stimulant to the sympathetic and is probably identical with tyramin. [It is interesting to recall that the enzyme erepsin is present in all active tissues as well as in the intestine.]

The main point is that, either through bacterial action or as a result of normal enzymatic metabolism of proteid, poisons arise with powerful actions on the nervous system. Normally they are stopped in the intestinal wall and liver; like that of asthma they are antagonised by atropin.

CHAPTER IX

MORBID ANATOMY, COMPLICATIONS, DIAGNOSIS

STRICTLY speaking, asthma has no morbid anatomy; it has a morbid physiology as already indicated; the morbid changes found are the result of repeated and prolonged attacks of dyspnœa. They have been well summarised by Goodhart. "These are more or less chronic inflammation of the bronchial tubes, shown by injection and thickening of the mucous membrane, thickening of the muscular coat of the bronchial tubes, emphysema of the vesicular structure, more or less thickening and atheroma of the branches of the pulmonary artery in the lung, and hypertrophy and dilatation of the right side of the heart. The changes in the skeleton that go with these are those of emphysema, the curved dorsal spine, the barrel-shaped chest, the stiffened ribs, the wasted frame." We can thus understand how in a patient with thickened bronchial muscles a fit of anger or of laughter may provoke spasm.

I have never had an opportunity of examining *post mortem* a case of asthma, but I have examined with the bronchoscope passed into the main bronchus a few days after an attack of asthma a man who had had frequent and prolonged asthma; there was no evidence of alteration of appearance in the bronchi. This does not count for much, for we want to know the state of the bronchioles, which are beyond a bronchoscopic examination. Berkart states that in the last twenty-five years he has been able from the literature to collect only seven post-mortem records of cases of asthma. In the first four there was marked kidney disease, and in one of these there was also carcinoma of lung; in the fifth, sixth and seventh the condition of heart and kidneys is not mentioned, but one died of pneumonia. Only in this fifth case and in the seventh case does there seem to have been no decided complication of the asthma, so that clear and certain inferences are difficult; but I quote Berkart's summary of the findings: “In all there was a mechanical obstruction of a large section of the bronchial tree by the substances which are observed during life in the sputa. In all the obstruction was in the medium-sized and small bronchi, in some also in a main bronchus and in one of its first subdivisions.' It was either complete or the mucous surface was more or less thickly plastered by the morbid products, so that little air could have entered and escaped from the lungs. In all cases the smaller and medium-sized bronchi were dilated. With the exception of two the walls were infiltrated with leucocytes and thickened by new growths. Small cellular infiltration existed also in the peribronchial tissue. In some cases there was considerable hyperplasia of connective tissue which projected in the form of polpyi into the bronchi. The mucous membrane was always congested; the vessels were over-distended and there were hæmorrhagic foci. In some places the epithelium was preserved; in one it was in a state of active mucous secretion; in others it was degenerated, necrotic and exfoliated, thus denuding almost the entire bronchial surface. Conglomerates of it were the chief constituent of the obstructing plugs. In the main bronchi were, in two cases, villous excrescences, in one catarrhal ulcers, and in another tracts of cicatricial tissue. The alveoli were for the most part emphysematous. Some of them were compressed by interstitial growth, others contained granular detritus or a homogeneous substance in which were embedded alveolar epithelium and leucocytes. Both ventricles of the heart were always dilated. The cardiac muscles were degenerated, and there was more or less extensive atrophy of the cortical parts of the kidneys." I wish to repeat that although emphysema must in the end produce heart disease I have in 200 cases of asthma looked for the latter, but only in one could I be sure of it by clinical examination.

With one exception the COMPLICATIONS of asthma, such as emphysema and albuminuria, in as far as they have not been sufficiently discussed, will be referred to under Prognosis. That exception, phthisis, is both important and interesting. It is important because it is not uncommon, is difficult of diagnosis and is mostly missed; it is interesting because, when we consider that we have to starve asthma and feed phthisis, the prognosis is not nearly so bad as we might expect. These two facts are related to each other. The phthisis hides behind and is retarded by the asthma; consolidation is concealed and cavitation hindered, by emphysema. It is amazing how long these patients live and how little the tubercular process makes headway, even in unlikely cases. One reason for this seems to be that the emphysematous distension causes pressure in fashion similar to an intrapleural injection of nitrogen gas. Probably this is not the whole story, for another interesting fact, rendering diagnosis difficult, is that tubercle bacilli are rarely found in the spit. I have seen the sputum examined over and over again by different experts, and even had it tested on guinea-pigs, with negative result. Why this should be I cannot explain; yet these cases may have hæmoptysis different in type from that of asthma, occasionally pyrexia and purulent spit, and usually a positive reaction to tuberculin. Suspicion of phthisis should always be aroused by the occurrence of pyrexia in an asthmatic adult—pyrexia in children is less serious, for this may be due to excess of carbohydrate food (Hale White) or even to constipation. This suspicion is strengthened if there is hæmoptysis of more than the scanty, streaky type characteristic of asthma, if there are occasional bouts of purulent expectoration, and especially if there is a family history of tubercle. A test tuberculin injection should at once be made; it is futile, and worse than futile, to wait for the appearance of consolidation or of tubercle bacilli in the spit. In an asthmatic a unilateral condition of any kind in the lung and "pneumonia" should always be suspected as tuberculous till the contrary is proved, and proved on exceptionally strong evidence.

To prove these statements I give a short resume of all cases of combined asthma and phthisis that I have seen.

CASES OF PHTHISIS COMPLICATING ASTHMA

(1) Woman, aged 30. First seen 1901. Asthma began after influenza three years previous. Attacks had a week-end tendency and began usually about 4 A.M. Intumescent rhinitis; paroxysmal sneezing. There was for some time repeated hæmoptysis with pyrexia, so that there was little doubt as to a tubercular element; but my notes are meagre and the patient removed from the district. I have, however, recently found her; she has been free of both asthma and phthisis for years.

In the next two cases I missed the tubercular disease, as also, in the first of the two, did three consultants. Both cases died, and this taught me to lay emphasis more on symptoms than on signs in such cases.

(2) Architect, aged 38; seen 1900. Bronchitis since childhood; bronchitic asthma for at least the last ten years. (Father seems to have had asthma.) In 1897, while suffering from asthma, he had "local asphyxia" of right thenar eminence, the part being first blanched and painful, and later dusky. This did not last above forty-eight hours, and never recurred. In February 1898 a severe cold in the head led to bronchitis; as this was passing off asthma came on, accompanied at night by urticaria; in that year were noted, marked emphysema, cardiac dullness obliterated; very deficient R.M. at right base; hypertrophy of turbinals and of septal tubercles, touching of which caused sneezing. Intranasal treatment was carried out at the suggestion of two consultants, but without benefit. Another consultant found collapse of lung at right base and ordered patient abroad. He went to Denver, where he improved for a year but then died somewhat rapidly of "pneumonic phthisis." Some months before death tubercle bacilli were found in the spit.

(3) Clerk, aged 22 when first seen in 1901. Had had asthma fourteen years, attacks being mostly week-end (Saturday night and Sunday). All turbinals hypertrophied so as to touch septum. In 1907 he reported himself free of asthma for years. Shortly after this I was told he had phthisis, of which he died in 1910.

(4) Merchant, aged 60; seen July 1911. Asthma began ten years before, after influenza; worse during last three years, latterly every morning at 7 A.M. on waking. Attacks last half-an-hour, and are relieved by expectoration of profuse, tough, stringy spit; the lungs are emphysematous. He steadily improved and had little asthma till in the winter he had an acute illness, said to be pneumonia. When he came to me in February 1912 I found an airless patch in right lung below scapula. He was very reluctant to let me try tuberculin and the patch may have been one simply of collapse, but it was so like Case 2 that I was strongly inclined to suspect phthisis, especially as he had lost flesh. Nevertheless he has remained very well, and actively at work.

(5) Miss Y., aged 29, seen 1910. A fragile woman with asthma for twenty years, coming on about 6 A.M., but worst on Sundays and confining her to bed half the week. At least two violent attacks of urticaria associated with asthma. Nose had been previously treated by a rhinologist without benefit to the asthma and required further treatment. After this and with other treatment she rapidly improved and became like another creature. She had had hæmoptysis repeatedly, had had her spit frequently examined for T.B. with negative result; inoculation of guinea-pig was negative. Her mother had died of phthisis. She was treated with tuberculin, which often caused pyrexia, but she improved so much that for a year and a half she was always fit, as she herself expressed it, and was not laid up with asthma, though she often had it slightly. There was doubtful dullness at left front, but it would be very difficult, probably impossible, for anyone not knowing her history to diagnose phthisis by the physical signs, though there is no doubt of the existence of the disease. Lately she came begging for further tuberculin treatment. I gave her an initial dose of sensitised tuberculin; within 48 hours she had an attack of asthma, or rather of persistent wheezing, without marked dyspnœa except on exertion; this lasted nearly a fortnight and resisted the usual remedies, but was eased by adrenalin hypodermically. I told her doctor she had phthisis, but warned him he would not make this out from the physical signs, and he did not. She has again much improved.

(6) This case is one of doubtful phthisis, as the tuberculin

test was not carried out; but the history is suggestive. A woman of 30 came in 1910 with history of severe asthma for eight years, mostly nocturnal and week-end; paroxysmal sneezing. She had twice hæmoptysis of more than asthmatic character, once after " pneumonia," and was sent to a sanatorium, when after six weeks she was dismissed because T.B. were not found. After a few months' treatment her asthma was cured.

(7) This man has already been mentioned at p. 46. His father and brother died of phthisis. He was seen in 1905 for bad week-end asthma during the previous six months. After removal of polypi and dietetic treatment he had no more asthma till in 1911 he took phthisis at right apex. This healed but he persisted in forced feeding, though warned he would have more asthma. He had two attacks, reduced his diet and has had no more asthma. The tubercular lesion has remained healed for a year.

(8) A lad of 17, whose sister died of phthisis and from whom he probably got the infection. He was seen in 1905 with history of bronchitis since infancy and asthma since the age of 8. Paroxysmal sneezing; hypertrophy of turbinals, epipharynx ill developed; some albuminuria. Asthma nightly for months together. No asthma for nearly two years; then, I learned, he took phthisis and died.

(9) This woman was a diagnostic puzzle to all who saw her. Very briefly put, her history is one of asthma beginning early in 1907 with profuse cough and spit; attacks worst at night; at first no pyrexia, no dullness, but wheezing rale in both lungs. By the following year her weight had come down from 148 lbs. to 116 lbs. and there occurred at intervals during this and the following year attacks with high temperature, night sweats and profuse, purulent, sometimes blood-stained, spit. No dullness could be detected, but crepitus was noted to be greater and to linger longer over the left lung, especially towards the base. The spit was repeatedly examined and gave Fraenkel's pneumococcus, staphylococci and streptococci, but never T.B.; streptococci alone were recovered from a localised abscess in an inoculated guinea-pig. Notwithstanding all the negative evidence I felt sure it was a case of asthmatic tuberculosis, an opinion confirmed by a positive

Calmette reaction and by a distinguished phthisiologist, who, after long watching of the patient, ultimately came round to my opinion. She was treated with tuberculin and made a fair recovery both from the asthma and the tuberculosis.

(10) This case was probably of similar nature to the last, though I have had much less opportunity of confirming the diagnosis. It at any rate serves to show how long a focal pulmonary lesion may complicate asthma and seriously incommode the patient without itself seriously advancing.

A woman of 60 had had a large goitre twenty years, chronic rheumatism, floating kidney, hernia, bleeding piles. Asthma started at the menopause nine years before I first saw her in 1910; attacks nearly every month, lasting a fortnight. "They begin with cough and dyspnœa; after a day or two there is slight, tough spit gradually becoming very profuse and sago-like, sometimes streaked with blood. The paroxysm usually ends with bilious vomiting, which gives relief. There is constipation, marked flatulence and during the attacks the urine is often reduced to ten ounces in 24 hours, is loaded with urates and shows great increase of ethereal sulphates. Patient is somewhat emaciated, with asthmatic cachexia and emphysema obliterating the cardiac dullness and depressing the upper border of the hepatic. At left axillary base is a small dull area with diminished breath sounds. Twice or thrice a year the asthmatic attack winds up with an acute febrile illness." In two of these I saw her; there was distinct pleural friction over the dull area, with distinct extension of the same, suggesting pneumonia; temperature 102, but falling to normal in the morning; in one attack there was also friction at the other base. The spit became profuse and yielded pneumobacillus, pneumococcus, streptococcus, M. catarrhalis and M. tetragenes; no T.B., Von Pirquet negative; I was not allowed to try tuberculin injection. The spit became more purulent and on two days showed traces of blood. A vaccine from the pneumobacillus gave no benefit; but the acute febrile attack subsided as before leaving her as before. Her asthma has been better of late. The rheumatic attacks alternated with the asthmatic and were characterised by pain and swelling of the knees and of the smaller joints of the upper limbs—an interesting condition as speaking also of toxæmia.

(11) Woman of 31, seen only once in 1908. Asthma for thirteen years, latterly almost daily, worse at night and after food; great flatulence; scanty urine loaded with urates; blood pressure 95; weight 94 lbs., formerly 126. Much yellow spit with some hæmoptysis. Though I could not tell so from the physical signs, she had phthisis and I understand died a year or two later.

DIAGNOSIS.—The diagnosis of asthma differs from that of most diseases in that it has often to be made in the absence of the disease, in the asthma-free interval; but the very fact of such intervals is some aid to diagnosis. The difficulty is greatest in incipient asthma. Dyspnœa, especially if nocturnal or after meals, coming on and passing off suddenly, leaving no trace or perhaps only a few cooing rales scattered through the lung, could hardly be anything but spasmodic asthma; this diagnosis would be confirmed by the absence of cardiac disease, of enlarged thymus, of albuminuria. If the attacks have been frequent, usually the patient has made the diagnosis; but in the early stage of the disease he may be puzzled. In children it is important to remember that recurrent and generally, but not necessarily, afebrile bronchitis, is nearly always of asthmatic nature; this may possibly be confirmed by the presence or history of eczema, or by a history of laryngismus or by the signs of rickets. These attacks are apt to be worse at night, and inquiry will probably reveal slop-feeding and excess of carbohydrate food. The rare disease, plastic bronchitis, may have affinities; it would be differentiated by the fibrinous tree-like casts in the expectoration; asthmatic casts are not tree-like and are not fibrinous.

In the presence of an attack the diagnosis has to be made from "renal asthma," cardiac asthma, thymic asthma. If there has been an antecedent history of previous attacks with signs of emphysema, there will be no difficulty. A wheezing, gasping patient, labouring at breathing, his chest full of whistling rales and distended to its utmost, presents a picture with printed title. Usually the diagnosis can be made without reference to the spit; but a slight, tough spit crammed with eosinophiles will, in conjunction with the other signs, settle the diagnosis, the more readily if Charcot-Leyden crystals and spirals be found; but it is to be remembered that spirals are often difficult to find.

If there is albuminuria the diagnosis is somewhat more difficult; but apart from the characters of the spit the character of the albuminuria itself will point the diagnosis. In asthma the urine is commonly scanty during the attacks, loaded with urates, and the albumin is slight. If there is albuminuria between attacks the albumin is slight and the specific gravity, contrary to what rules in renal cirrhosis, is moderate, between 1010 and 1020 instead of about 1005. Besides, renal disease that has got the length of affecting the breathing will give other unmistakable signs, such as oedema, albuminuric retinitis, blood- and tube-casts, high blood-pressure as distinguished from the comparatively low pressure of asthma. The dyspnœa of asthma suggests spasm to one's face; that of renal disease is rather an air-hunger than dyspnœa (Goodhart). I once mistook this condition for asthma till the blood pressure of 200 set me right. The reverse error is more common, that of mistaking incipient asthma, especially after the age of 50, for renal disease.

CARDIAC ASTHMA is another likely source of mistake. Fraenkel thus describes it. Sudden, nocturnal attacks of severe dyspnœa in subjects of arterio-sclerosis, with laboured expiration and inspiration, often ending in Cheyne-Stokes respiration. The patient is both pale and cyanosed; pulse is of high tension but may not be rapid or irregular. The dyspnœa may be followed by coughing up of scanty, viscid, dirty-red sputum. Fraenkel's view of the mechanism of this dyspnœa makes the likeness to bronchial asthma still greater. He thinks the condition due to swelling of the bronchial mucous membrane, to spasm of the bronchial muscles, and to secretion of viscid mucus; and points for supporting evidence to the fine rales all over the lungs during the attack. Hugh Barber publishes four cases, all elderly men with enlarged heart; bruit may or may not be present. It is to Mackenzie that we are most indebted for our present knowledge of this condition. It is usually a near forerunner of death. I have not, to my knowledge, seen it; for all the senile cases of asthma I have seen have steadily improved and, indeed, are well; but obviously every case of senile asthma should be suspected as being of this nature till the contrary is sure. The combination—advanced age, arterio-sclerosis, high blood pressure—is sufficient to class a case as cardiac rather than bronchial, the more so if there is enlarged left ventricle, presence of albuminuria, absence of emphysema, of the characteristic triad of the asthmatic sputum and of eosinophilia.

THYMIC ASTHMA is mentioned because of the name. "The cause of the dyspnœa is the mechanical pressure of the enlarged thymus on the trachea, great vessels and nerves." It is mainly a condition of early life, and is part of the status lymphaticus, of which the features are enlargement of the thymus, of the lymphatic glands, and of the spleen ; excess of subcutaneous fat and evidences of infantilism ; there are anomalies of heart and arteries, and a low blood pressure (see paper by Cocks). I have seen two cases in one family; both died of suffocation.

MEDIASTINAL TUMOUR I have known to confuse the diagnosis ; but a careful examination of the chest, especially with the differential stethoscope, attention to the history, and the progress of the disease, will make the case clear.

CHAPTER X

PROGNOSIS

It is unfortunate that the current idea among general practitioners as to asthma is that it is incurable; for there is no distressing and disabling diseased condition more amenable to correct handling than asthma. Every case of *uncomplicated* asthma, properly handled, will improve; most will get well. It is interesting and useful to see what conditions Hyde Salter found unfavourable to prognosis; for not one of them now matters to the extent that he thought.

(1) Age. "In young asthmatics the tendency is almost invariably towards recovery; whereas in a person who is attacked with it after 45 the tendency is generally towards a progressive severity. . . . In no disease does age affect prognosis more." In neither respect can I quite agree. While a large proportion of young asthmatics "grow out of" their trouble, many, unless carefully treated, steadily get worse. What does affect the prognosis unfavourably in the young is a strong hereditary tendency; but this must be carefully distinguished from similarity of vicious upbringing in the members of the same family. The case of the boy mentioned on p. 33 illustrates this. There was a strong hereditary tendency on both father's and mother's side to gout, uric acid and asthma. He was accord-

ingly difficult to treat, for the slightest deviation from a very strict dietary brought back both eczema and asthma; yet when this was attended to the response to treatment was excellent.

On the other hand, senile asthma—that is, asthma beginning after the age of, say, 45—has responded well to treatment, and where the treatment has been thoroughly carried out the patient has got well, or practically so, provided there has been no serious complication. Probably some of Hyde Salter's cases of senile asthma were cases that would now be recognised as cardiac asthma, and this would, of course, unfavourably influence his prognosis.

The table on page 130 is a complete list of my senile cases so far as I have been able to trace them.

These cases speak for themselves, but not well enough; for some of them had pretty severe asthma, and in Cases 4 and 6, which are marked "improved" and were seen many years ago, the treatment was mainly nasal, as I had not then found out efficient antitoxæmic measures. The list also proves the value of properly combined treatment for the nose and the toxæmia.

(2) Salter's next point is "the presence or absence of organic disease in the respiratory and circulatory organs." The presence of such disease is really one of the most unfavourable elements in the prognosis, and yet Salter's further statement that in such circumstances "recovery is *impossible,*" is not correct. In the list of senile cases given, Case 7 had cerebral thrombosis and Case 11 heart disease, yet both got quickly clear of their asthma. Pulmonary lesions are more serious than circulatory for the prognosis of the asthma; yet in the list of phthisical cases given on

CASES OF SENILE ASTHMA

No.	Age	Duration	Nasal and other Complications	Result
1	70	1½ years	Polypi, oedematous turbinals, emphysema, albuminuria.	Well; slight albuminuria.
2	62	3½ ,,	Polypi, turbinal hypertrophy, emphysema. Bronchitis for 3 years before asthma.	Well.
3	68	2 ,,	Preceded by bronchial and nasal catarrh for a year.	Well.
4	68	2 ,,	Polypi.	Slight improvement but dietetic treatment not thorough.
5	60	12 ,,	Polypi, extensive double ethmoid disease.	Well.
6	66	13 ,,	Bronchitis 30 years; polypi bad.	Much improved; dietetic treatment indifferent.
7	63	One attack	Cerebral thrombosis.	Still in good health 6 years later.
8	70	2 years	Obesity.	Well, when seen 3 years later. Present age, 77.
9	70	3 months	Wants a leg. *N.B.*—The asthma did not arise till some time after the loss of the leg.	Well, seen 2 years later; but afterwards some recurrence. Dietetic and other regimen poor.
10	66	5 years	Persistently recurrent polypi operated by other surgeon.	Recent case, already improved by dietetic and drug treatment.
11	53	3 years	Obesity.	Seen once in consultation; asthma got well; died 2 years later of heart disease.

pp. 120-123 will be found two, if not three, cases of cure and several of improvement. Much, very much, depends on the phthisis being diagnosed early and, as already shown, this is often very difficult in asthmatics.

(3) Salter's next point is "circumstances in past history," such as the length of the attacks, their frequency, the completeness of recovery between them, the persistence of expectoration, the direction that the disease appears to be taking, and our ability to detect the exciting cause (certain articles of diet, and the so-called "place" asthma). Now, where nasal and antitoxæmic treatment is thorough, not one of these points matters much except in one respect. If the course of the disease has been such as to produce marked emphysema the prognosis is the more unfavourable; yet such cases have already been quoted showing absolute or comparative recovery from the asthma. (See especially the case quoted on p. 32, where there was pronounced emphysema from severe and frequent asthma recurring during nearly thirty years.) The most difficult cases of this class to treat are those in working people, because they cannot get the dietetic and dental attention necessary. Perhaps the best way to answer these points of Salter's is to give a complete list of all my cases where asthma has lasted at least ten years. This is more truthful than statistics, which "are deceivers ever," and would be specially so here; for (1) no mere figures can express the severity of the asthma or the amount of improvement, and (2) it has always to be kept in mind that many of these cases came to me before the proper treatment of the toxæmia was apparent to me—say, seven years ago.

CASES THAT HAVE HAD ASTHMA AT LEAST TEN YEARS

The nasal condition is given as proving the importance of this factor; in the earlier cases attention was given mainly to this and to drug treatment; in the later the toxæmia was also treated as much as possible.

Nose-block=nasal obstruction; A=asthma; turb.=turbinal; hypert.=hypertrophy.

In two cases of no improvement the one obvious cause has been italicised.

No.	Date of Note	Age	Duration in Years	Nasal or other Complication	Severity or Frequency	Result
1	1891 to 1896	56	12	Nothing in nose, chronic bronchitis many years previous to asthma.	Bad.	Considered herself cured, had no more "spasms," but occasional "tightness."
2	1898	33	10	Nose-block.	Bad.	Cured for 6 years till death from cancer.
3	1912	60	12	Nose crammed with polypi; sinusitis of both ethmoids and left sphenoid; emphysema.	Nightly for years.	First treated for polypi in 1899, and later, without improvement to asthma. In 1909 sinusitis and polypi radically treated; proper antitoxæmic treatment. No asthma since.

4	1897	52	15	Hay fever, polypi, nose-block, emphysema.	Moderate; worst in hay-time or from dust.	Polypi removed in 1897; no asthma till 1906, then more polypi and asthma; these removed 1910; no more asthma.
5	1895	16	11	Nose-block from polypi and hypert. turb.	Moderate.	No asthma after nasal treatment.
6	1911, but seen during preceding 10 years	28	20	Nose-block from septal twist and spur, etc.; dermatitis herpetiformis.	Bad and frequent from atrocious diet.	Well, except rarely from dietetic excess.
7	1901	22	14	Marked nose-block.	Nocturnal and week-end.	1907 reported himself free of asthma for years; later took phthisis and died.
8	1900 and later	67	14	Bad nose-block, recurrent polypi.	Bad; several times thought to be dying.	Much improved by nasal treatment. Is now (1912) 80; no asthma for a year; arteries soft, heart sounds pure, no sign of emphysema.

No.	Date of Note	Age	Duration in Years	Nasal or other Complication	Severity or Frequency	Result
9	1900	22	10	Nose-block from polypi and hypert. turb.; hay fever.	Very bad; attacks week-end, menstrual and hay-time; hæmoptysis, petechiæ.	Much impr. from nasal treatment till 1904, then regimen altered and asthma cured till 1912, then bad regimen and recurrence of asthma; sept. resect; cure of asthma.
10	1899, but also from 1893	22	19	Nose-block almost complete; repeated pneumonia; emphysema; barrel-chest.	Very bad and frequent; nearly every Monday.	Much improved by nasal treatment; took to alcohol and died of pneumonia, 1900.
11	1900, and for 5 years before	38	10. Bronchitis from childhood.	Marked turbinal hypert.; marked emphysema; collapse or phthisis at right base.	Severe and frequent.	No improvement. Died in Denver of "pneumonic phthisis."
12	1906	42	20	Polypi, etc.; emphysema.	Very frequent (Sundays), but moderate.	Much improved, but careless as to diet.

13	1912	68	32	Polypi, etc.	Frequent and severe nearly all winter.	Asthma began age 36 with "croup" (? laryngismus); disappeared after nasal and other treatment. Exoph. goitre 4 years ago, lasted 18 months. One slight attack of asthma this year.
14	1906	25	20	Nose-block; polypi; *alcoholism.*	Bad.	Little improvement.
15	1905	17	From infancy.	Nose-block; epipharynx ill-developed; emphysema; albuminuria.	Bad.	No asthma 1906; 1907 took phthisis and died.
16	1903	23	Bronchitis till 12; then A. to date.	Oedematous turbs.; eczema.	Frequent and severe.	Cured.
17	1906	40	20	Septum deflected; emphysema.	Every Monday.	Cured. Sept. resec.
18	1904	28	From infancy.	Turb. hypert; spur.	Moderate.	One attack in 4 years.

No.	Date of Note	Age	Duration in Years	Nasal or other Complication	Severity or Frequency	Result
19	1912	28	12	Nose-block; polypi, moriform, septal deviation.	Moderate; often week-end.	Nasal treatment, 1904; asthma much improved; septum resected, 1912, and dietetic treatment begun; 3 months later reports himself very much improved.
20	1904	15	From infancy.	Hypert. turbs., sept. deviat.	Severe, often week-end.	Remained well till 1907, then some recurrence, and resection of septum; cure.
21	1911	30	25	Oedemat. hypert. of turbs.; idiosyncrasy to eggs; pneumonia twice; no decided emphysema; hay fever.	Worst at menstr., and 4 A.M.	Practically well.
22	1907	35	Lifetime.	Nose-block on left; hypert. turb.	Frequent on Sundays.	Careless as to treatment, but much improved on taking only two meals a day.

23	1908	38	10	Paroxysmal sneezing.	Chiefly in spring and before menstruation.	Much better.
24	1908	30	Lifetime.	Nose-block; many nasal operations.	Severe, sometimes lasting a week.	Asthma well while dietary strict; patient careless, but much improved.
25	1909	42	10	Paroxysmal sneezing and rhinorrhœa sometimes for a whole day. Turb. hyp.	All winter for last 4 years.	Much better.
26	1911	61	10	Goitre; probably phthisis; floating kidney; repeated pneumonic attacks.	Bad; often every month and after meals.	Improved.
27	1908	31	13	Phthisis.	Bad.	Asthma no better; died of phthisis.
28	1908	36	10	Nose-block.	Moderate; frequent in June and July; often every Monday morning.	Cured.
29	1907	41	15	Complete nose-block, turb. hypert, etc., resected septum, etc.	Nightly, worse and most regular on Sunday.	Well.
30	1911	53	13	Turb. hypert.; spur; marked emphysema; *no teeth*.	Almost every morning.	Improved in severity, not in frequency.

No.	Date of Note	Age	Duration in Years	Nasal or other Complication	Severity or Frequency	Result
31	1908	33	17	Nose-block from hypertrophy of all turbinals; emphysema.	Sundays, often menstrual.	Much improved, weight increased from 97 lbs. to 102 lbs. in 3 weeks.
32	1912	17	Lifetime.	Adenoids bad in childhood; some nose-block.	About fortnightly, especially Sundays; severe.	Cured.
33	1912	36	10	Nose-block; sept. res.	Moderate, often menstrual.	Cured.
34	1912	43	12	Turb. hypert.	Severe; daily.	Nearly well.
35	1912	18	Lifetime.	Nose-block; emphysema.	Occasional.	Well.
36	1912	30	Lifetime.	Polypi; ethmoid resected, sphenoid opened.	Daily for months.	No improvement after the nasal operations which were by another surgeon. Cured by antitoxæmic treatment.
37	1912	38	20	Nothing in nose; no emphysema.	Frequent and fairly severe.	Still under treatment; but much improved.
38	1911	60	10	Turb hypert., emphysema; bad teeth; tubercle or collapse in left lung.	Severe and latterly daily.	Well until development of disease in left lung. Remains much improved.

39	1911	37	17	Paroxysmal sneezing. Nose-block; sept. resected. Uterine fibroid.	Severe; frequent, often week-end.	Well.
40	1911	38	9	Sept. resect., no emphysema; hayfever, 12 years.	Moderate; bad in autumn and at menstruation.	Hay fever cured after sept. res. by other surgeon, 1910; no improvement in asthma till anti-toxæmia treatment, then cure.
41	1912	42	30	Sept. resect; albuminuria; no emphysema.	Moderate.	Doctor reports patient well but more time is necessary.
42	1911	22	17	Bronchitis since 5; hay fever.	Severe but seldom.	Well.
43	1911	55	17	Spasmodic rhinitis, hypert. tubercle; sept. deviated; no emphysema.	Frequent but moderate.	Declined treatment.
44	1911	47	20	Nose-block, emphysema, pneumonia (double), pleurisy, hæmoptysis.	Worst on Sundays.	No improvement; declined treatment.
45	1912	40	20	Whole nasal mucosa thickened by fibrous change; eczema.	Frequent and severe.	Much improved.

No.	Date of Note	Age	Duration in Years	Nasal or other Complication	Severity or Frequency	Result
46	1911	14	10	Nose-block.	Severe and frequent, especially Sundays and Mondays.	Well, chest girth increased by 2 in., expansion by 1 in., weight by 23 lbs.
47	1909	58	28	Sept. res. with large perforation; polypi; pharyngitis sicca; marked emphysema.	Very severe and for years every night.	Practically well. (Sept. had been resected by another surgeon without improvement.)
48	1911	29	27	Nothing special in nose.	Continuous for weeks, then months free.	Well.
49	1910	70	42	Bronchitis frequent for 60 years; eczema; polypi.	Frequent but not severe.	Nearly well. (Polypi had been treated without improvement.)
50	1910	29	20	Nose had been previously treated for turb. hypert., etc.; phthisis; emphysema.	Frequent, prolonged and severe.	No improvement after nasal treatment by other surgeon, remained very well after antitoxæmic treatment; relapse after sensitised tuberculin injn.[1]
51	1911	43	11	Sept. dev.; irritable tubercles; pharyngitis; emphysema; hay fever.	Moderate.	Well.

---

[1] Is again very well.

Analysis of this table of asthma of *more than ten years' standing* gives the following percentages in the first column, or, if we exclude cases seriously complicated or declining treatment, the percentages in the second column :—

Cured or practically cured	63	76·4
Improved	30	21·3
Not improved	7	2·3

These cases clearly prove the value of combined nasal and antitoxæmic treatment. Many of them had had nasal treatment by others, some by myself, with little improvement, but promptly improved and got well when antitoxæmic treatment was carried out. In some the improvement ensued where the nasal treatment had been imperfect and was then thoroughly done, but at the same time antitoxæmic treatment was always begun.

The conditions that really affect asthma unfavourably may be summarised as follow :—

(1) Pulmonary complications : phthisis, collapse of part of lung, marked emphysema. As has been shown by the above records, not one of them, unless pronounced, is of hopeless prognosis for the asthma. Phthisis and collapse have been dealt with ; if the emphysema is not great, there is a fair prospect for the asthma when the toxæmia has been got under and nasal respiration secured.

(2) Permanent mouth-breathing is an almost hopeless complication ; for, sooner or later, this means permanent disturbance of the lower respiratory tract as well as defective oxidation of the tissues.

(3) Bad teeth or few teeth mean constant inter-

Important!

ference with digestion and toxic absorption. If a patient will not have these put right it is best to decline treatment. A patient will get more readily well with a defective nose.

(4) Lameness hurts the prognosis[1]; for active exercise is essential to proper oxidation of food and tissues; patients so handicapped are apt to overfeed.

(5) Albuminuria, even when slight, if constant, means slow recovery and proneness to relapse, but does not bar great improvement, or even cure (see Case 1 of senile asthma, p. 130).

(6) Inability of the patient from social or other circumstances to give due attention to a proper hygiene, as often happens in the working class, is, of course, a serious factor. Many patients also, after years of a weary round of nasal treatment, drugs and proprietary nostrums, lose all hope; and this hopelessness is naturally difficult to break down. Most serious of all is when these patients have been made by their disease, too often by their doctor, slaves to drugs, alcohol, opium, atropin, cocain or adrenalin. These are almost hopeless cases.

(7) Flatulence, persistent and pronounced, injures the prognosis, but may, of course, be overcome. Organic digestive disease is quite unfavourable.

(8) Idiosyncrasy to eggs, and more especially to fish and iodides, is unfavourable because of the extra difficulties involved in treatment.

Note that week-end asthma ought always to be cured.

As final proof of the tractability of asthma, and as the only way of enabling the reader to judge of the fairness of the statistics without tediousness, a short record of twenty-five consecutive cases from my Glasgow practice is given. They are taken backwards from about the middle of 1911 so as at the same time to show permanence of result and to ensure the cases being traced. A few of them have already been mentioned in previous tables; but a more detailed account will enable the reader to judge for himself statements already made as to favourable prognosis in seemingly hopeless cases. In the narrative only a few details of treatment special to the case are given, as in nearly every case the therapeutic measures mentioned in the next chapter were carried out. These include careful dieting, occasional fasting and systematic exercise. It is interesting to note that dieting and fasting in thin, cachectic asthmatics often cause increase of weight; obese asthmatics require to have their weight reduced, but they are the exception.

---

[1] See Case 9, p. 130.

By "cure" is meant that asthmatics remain free of their attacks so long as they remain reasonably faithful to the regime laid down, yet without needing after a certain period to take drugs except a weekly mercurial. It does not mean that a patient, once asthmatic, is free to indulge in the pleasures of the table *ad lib.* That, persisted in, would always cause recurrence.

TWENTY-FIVE CONSECUTIVE CASES OF ASTHMA

(1) Andrew L., aged 60, came in July 1911 complaining that asthma began ten years previous after influenza. Attacks have been worse during the last three years, and especially in winter; latterly he has had an attack every morning at 7 A.M. on waking, lasting half-an-hour. It begins

with cough, and he gets relief after putting up a quantity of tough, stringy mucus. Fog and damp or a whiff from a tar boiler will start an attack. Teeth bad ; blood pressure 120 ; emphysema. Sneezes readily ; both middle turbinals oedematous, especially the right, which I snipped off ; tubercles cauterised. It was noted that the volume of the respiratory murmur was less over the right than over the left lung. As there had been slight hæmoptysis the spit was examined for T.B. and also guinea-pigged with negative result ; tuberculin test twice negative. In October he had an acute febrile illness like pneumonia of right lung and lost 6 lbs. weight. The dullness over right lung slowly cleared except a patch below the scapula. This still remains with impaired movement of the lung. He has now, however, practically no asthma.

(2) Girl of 7 came, February 1911, with history of one year's asthma starting after whooping-cough ; attacks nocturnal and worse in summer. Adenoids removed by one surgeon and nose cauterised by another without improvement ; patient still a mouth-breather. There was not pronounced dyspnœa but coughing and wheezing during attacks. Treatment dietetic and medicinal. Next year her doctor reported that he had never required to attend her again for asthma.

(3) An old man of 70 came in May 1911 with history of asthma beginning eighteen months before after exertion in a storm. He had slight albuminuria, which had caused his complaint to be mistaken for renal asthma. The quantity of urine was normal ; sp. gr. about 1015 ; blood pressure 165 came down under treatment to 130. Decided flatulence and some emphysema ; but arteries soft ; some feebleness of first heart-sound after exertion. Attacks were very severe and frequent, about 2 A.M. on most mornings. There had been no previous history of asthma or eczema and the only family trace was in a sister's daughter, whom the old gentleman brought to me some months later for asthma starting after pregnancy about a year before, and who promptly got rid of it. His left nostril contained polypi, and it was noted that sibilant rales were much more obvious in left lung than in the right. Under treatment partly nasal, mostly dietetic and medicinal, he slowly got quite rid of asthma. The signs of emphysema have diminished.

(4) Miss R., aged 37, seen May 1911 for asthma beginning seventeen years before after influenza. "Latterly the attacks have been almost daily, coming on about 3 A.M.; they are worst at week-ends and are often bad enough to confine her to bed a fortnight. Such attacks are preceded by somnolence; she will get into a deep sleep and be waked by dyspnœa and wheezing; during the attack she is irritable, perspires, is nauseated, has 'bilious' headache and vomits. She says she feels as if the asthma were always worse in right lung; examination proves this is so and it is noted that nose-block is worse in right nostril owing to septal deviation, spur and turbinal thickening. She suffers from anæmia due to uterine fibroid; has marked flatulence and no lower teeth." Artificial teeth were procured, the septum resected and other nasal treatment carried out; she was made to rest during menstruation but ordered active open-air exercise at other times. Under this and other treatment she rapidly improved and has remained free of asthma, although she lives in a very damp valley in the west of Scotland.

(5) Miss S., aged 38 (July 1911), had had hay fever twelve years, asthma nine years. Attacks began with streaming of hot water from the nose, soaking a dozen handkerchiefs in a short time; pruritus frequent; no emphysema. The attacks began in May and lasted more or less for four months; were worst at menstruation and came on at 4 A.M. The coryza and asthma, however, might occur at any time of year. Septum had been resected by another surgeon in December 1910, since which there has been no hay fever, but asthma remained much the same. When she came to me there was a large septal perforation in which were large crusts covering the necrosing vomer. The diseased parts were removed and she was otherwise treated. She slowly improved but had decided asthma in September 1911; since that she has remained well and improved greatly in general health, activity and appearance.

(6) Rev. X., aged 42 (June 1911). Asthma began thirty years before and was pretty constant till he went to the Transvaal in 1904, where he was 6000 feet above sea-level and free of asthma for four years. It recurred in 1907 on his return to the coast; albuminuria was found, and he was thought to be suffering from renal asthma and given a very gloomy

prognosis. He was treated by several doctors, but got most help from a proprietary " cure," which kept him fairly free of asthma for months before his return to this country. The asthma was nocturnal in onset and it is worth note that Sunday, which was his day of hardest work, was always his best day as regards asthma. Although he had had prolonged asthma and bronchitis there was no emphysema; and although there was slight albuminuria the blood pressure was only 120. A good prognosis was given accordingly. His septum was resected for deviation. He had some recurrence of asthma on returning to the Cape, but since that has remained well. He used to fear certain places for asthma even not far removed from others in which he would be well; but inquiry elicited the fact that the former places were damp.

(7) (May 1911.) A cachectic-looking boy of 4 years, with bad teeth, sallow skin and adenoids; dare not take eggs or fish, which cause vomiting; prognosis thereby injured. " Bronchitis " began when he was ten months old and slowly became typical asthma; the last two summers he has been wheezy all the time. He has had bad urticaria and eczema. Sardines provoked urticaria and asthma. The tonsils and adenoids were operated on and the nose cauterised, but he still remains somewhat of a mouth-breather. He remained free of asthma for some months after this and other treatment was instituted, had some relapse but has now been well for six months.

(8) R. H. (June 1911). A lad of 22 with yearly attacks of severe asthma lasting for some weeks since he was five. Hay fever; meal-times irregular and dietary bad; flatulence. Tubercles cauterised and diet supervised. Cured.

(9) (May 1911.) Widow, aged 47; asthma seventeen years and very persistent during last twelve; is worse in summer than in winter and often occurs daily at 4 A.M.; is worst on Sunday nights. Patient is careless as to diet, has flatulence and sometimes pain after food. The heart intermits and there is some emphysema, blood pressure 110. Patient had double pneumonia a year before and again shortly after I first saw her. She has much sneezing and the left middle meatus is blocked. She never properly carried out treatment and remained much the same.

(10) A lady of 42 came in March 1911 complaining of slight asthma during last year or two, probably connected with induced menopause after a uterine operation. There was some obesity and anæmia, much flatulence and true hypertrophy of right inferior turbinal. After treatment, mostly dietetic, she was cured.

(11) (March 1911.) A man of 62 with typical asthmatic cachexia. Bronchitis began six years ago, developing into typical asthma in three years. At first the attacks were mostly in autumn and continued during two or three months, but last winter the asthma occurred nearly every night with much wheezing, dyspnœa and frothy spit. Emphysema distinct; polypi in both nostrils and enlarged turbinals. These were treated and the diet and exercise put right. The attacks at once became less severe and after a few months entirely left him. Though he fasted as directed he put on 9 lbs. in weight.

(12) R. C., aged 35 (March 1911). He had constant trouble in his schooldays, summer and winter, with "bronchitis" and after he started work had for two or three years one of these attacks nearly every Sunday night; he then became quite free of asthma for four years. During the last two years, however, he has had about a dozen attacks a year, rendering him quite helpless for two days; these attacks were usually at 2 A.M., were sometimes week-end. These were always preceded by constipation and during the last two there has been decided hæmoptysis. He had had polypi removed and his nose cauterised by another surgeon without benefit. Flatulence constant. Dietetic and other antitoxæmic treatment soon cured the patient. It was noted in this case that rales were more pronounced in the right lung and nasal obstruction much more pronounced in the ipsolateral nostril.

(13) J. B., aged 14 (March 1911). Bronchial asthma began at the age of 4; each attack being preceded by "bronchitis," often beginning with a "chill," and ending with vomiting. Attacks recurred once a month or oftener and lasted a week; were worse Sundays and Mondays and at 3 A.M. The paternal grandfather had asthma, the maternal grandmother had bronchitis. Patient was a puny, timorous boy with ill-developed physique, chest, palate and nose.

Four years previous tonsils and adenoids had been operated by another surgeon without benefit to the asthma. Diet and hygiene were bad. A more unlikely subject for cure it would be difficult to imagine; nevertheless he has become quite free of asthma. His turbinals, which were enlarged, were reduced; orthodontic methods were used for widening palate and nose; his diet, which was viciously wrong, was altered; he was made to take open-air exercise and special respiratory exercises. His chest girth at the nipples increased in nine months from 26 in. on deep expiration and 28 in. on deep inspiration to 27½ and 30½ in. respectively; his weight from 75 lbs. to 98 lbs. Altogether he is hardly recognisable as the same boy, mentally, morally or physically. Expansion of palate in 2 months was 5 mm.

(14) The case of another boy seen at the same time with almost identical history, treatment and result, need not be detailed. The expansion of his palate by orthodontic plate in three months was 4 mm.

(15) W. W., aged 43 (January 1911). He had had asthma fourteen years and used a proprietary spray every night and morning. He was cachectic, addicted to coffee and had marked emphysema. There was not much wrong with the nose except a somewhat deviated septum and sensitive tubercles. He was subject to hay fever. He was made to give up the spray and the coffee; diet and exercise were supervised. When last heard of he had no more asthma.

Many more cases with equally good results might be taken from the latter part of 1911; but to prevent the permanence of the good results being questioned the remaining cases are taken *seriatim* prior to 1911.

(16) Miss B., aged 38 (October 1910). Asthma began two years previous, after overdosing with milk; but she had had bronchitis since childhood. She was anæmic without marked emphysema; but had poor chest development and expansion; had a poorly developed nose and a deviated septum, the result of adenoids in childhood. She was a hopeless mouth-breather, with unsatisfactory domestic surrounding which prevented treatment being properly carried out, and only slightly improved.

(17) Mrs Mc., aged 30 (October 1910). Married ten years. After the birth of her second child she went to stay in a damp house, caught a severe cold, had constant sneezing and coryza, and asthma began—*i.e.* eight years prior to date. She was never longer than two months without an attack, but during the last three years she has been waked with asthma every morning about 3 A.M. and has had to burn an asthma powder for relief; even during the day she has wheeze. There was sometimes epistaxis and last winter slight hæmoptysis for two days. She was therefore sent to a sanatorium in June 1910, where she remained six weeks without any asthma. As no T.B. were found she was sent home, where the asthma promptly returned as before. The attacks were worst on Sundays. She had constant sneezing, constipation, flatulence, poor teeth and bad leucorrhœa. She took two poisons at bedtime, paregoric and hot milk. Her irritable nasal tubercles were cauterised, the poisons stopped, the diet and exercise supervised, certain drugs were prescribed, and the asthma soon disappeared.

(18) Miss Y., aged 29 (October 1910). This case is complicated by phthisis and is given in the list of such cases on p. 121; some further details may be given. Asthma began twenty years before date, has been very severe, latterly occurring daily about 6 A.M., and often lasting all day; the attacks were often worst on Sundays. Her mother having died of phthisis, she herself having had repeated hæmopytsis and pyrexia, and having a weight of only 89 lbs., her sputum was repeatedly examined for T.B. and even guinea-pigged, but always with negative result. No dullness could be detected in the lungs but she repeatedly reacted positively to tuberculin hypodermically. It is true that her left lung moved less than the right and that its respiratory murmur was of much less volume than that of its fellow. But this difference is to some extent discounted by the fact of the ipsolateral nostril (left) being the more obstructed, a fact that must always be weighed in asthma. Nevertheless I am of opinion that her left lung is tuberculous. At first she lost weight under treatment, which involved occasional days of semi-starvation and a long course of tuberculin (P.T.O.) injections. But notwithstanding many domestic difficulties she slowly regained weight and after six months she said she had not been so well for years; in this all her friends

agreed. This improvement, manifest in her external appearance and renewed activity as well as in her comparative freedom from asthma, was maintained for a year. She returned to me keen for a fresh course of tuberculin injections, and although inclined to let well alone I reluctantly gave her a dose of sensitised bacillary emulsion. To this she seemed to react violently. At any rate because of this, or possibly because of a cold she thought she had caught, she had a severe illness, mostly asthma, lasting for many weeks. I told her doctor she had phthisis; yet though he examined carefully he could not make the diagnosis. She is again steadily rallying.

(19) Miss M'I., domestic servant, aged 35 (June 1910). Asthma began over eight years before date; she thinks she had hay fever before that. It got progressively worse, latterly became regularly week-end and during the two months before consultation she had been only two days a week free. She had been treated with morphia and by nasal operation without benefit. As often occurs, milk and stews provoked asthma; flatulence and constipation were marked features. Her septum was greatly deviated, the right middle turbinal cystic and jammed against the septum, the left also much enlarged, the right antrum dull to transillumination. The turbinals were treated, her diet altered and notwithstanding regular days of semi-starvation she put on 14 lbs. weight. Her cachexia cleared up and the asthma steadily improved. This improvement lasted six months; then her right antrum began to give increasing trouble. It was opened below the lower turbinal with some improvement to the suppuration. The radical operation should have been completed and her septum resected; but her position as a domestic servant stood not only in the way of this but also of thorough hygienic treatment. Yet her asthma, which had got somewhat worse *pari passu* with her antrum trouble, remained much better than before treatment was begun and she left for Canada while further nasal treatment was in contemplation.

(20) Mrs M'K., aged 32 (March 1910). Asthma for five years; always for a week at menstrual times and during the last two years practically every week-end. It laid her up for five months last winter and has occurred every night for the last three weeks. The attacks cause lividity and have

reduced her weight from 12 stone to 10. Nose had been twice operated without benefit. The diet has been bad and tea has been taken four or five times daily; there has been marked flatulence. The left nostril is obstructed by septal deviation.

Treatment included alteration of diet, resection of septum, treatment of turbinals and other measures. Patient quickly improved, got quite well and remained so as long as she observed dietetic rules; these she sometimes transgressed and paid in asthma.

(21) A doctor, aged 70 (December 1909). "Bronchitis" sixty years, typical asthma forty-two years; he had also eczema and oxaluria. He would have three or four attacks a year, lasting a week; but during the last two months he had asthma every night. The attacks have become markedly nocturnal only during the last year. The nose had been treated for polypi, etc., three years prior to date. Treatment was mainly dietetic and resulted in great improvement.

(22) A girl of 10 (December 1909). Asthma for two years, becoming almost constant during the last three months. Before typical asthma set in there had been "bronchitis," and even after asthma started she had attacks that were called bronchitis but were really asthma. Tonsils had been removed by a surgeon when patient was 4½; but she still remained a mouth-breather owing to turbinal enlargement. This was treated, the diet altered, open-air exercise prescribed, and in a short time the patient was cured and has remained so.

(23) (December 1909.) An old gentleman of 68 who had had asthma for two years, latterly more than once weekly. The asthma had been preceded by nasal and bronchial catarrh for a year. There was some occlusion of right nostril owing to septal deviation. Treatment by diet, exercise and drugs. Cure.

(24) This case (seen November 1909 and detailed on p. 32) is that of the man of 58 who had had asthma twenty-eight years, and who for years had never been a whole night in bed owing to asthma and whose attacks were so severe that he had sometimes to stand resting at a mantelpiece for a whole day or longer. He considers himself practically well.

(25) A boy of 8 years (October 1909). He had had asthma for eighteen months, had nose-block from turbinal enlargement; he had also enlargement of tonsil and uvula. These were all treated; he was kept off school, dieted, and cured. His father, a typical cachectic asthmatic, had had to give up work years before owing to asthma and was also cured; but his case occurred prior to this series of twenty-five cases.

This list gives a percentage of 76 cured, or practically so; of 16 improved; of 8 unimproved; and experience shows that this is a fair estimate. Of the two patients constituting the 8 per cent. unimproved one was slightly weak mentally and never properly carried out the treatment; the other was a permanent mouth-breather and from her domestic circumstances never got a proper chance to carry out treatment. Of the 4 patients constituting the 16 per cent. improved, 1 is nearly well, 1 has phthisis and of the other 2 I have not heard recently.

It is very interesting to note the practical identity of these percentages with those given on p. 141 for asthma of more than ten years' standing.

CHAPTER XI

TREATMENT

WHAT is here said about treatment will be confined to what my own experience has proved successful. Vasodilators, for reasons already stated, are not of much use; general anæsthetics are rarely, if ever, necessary; bronchoscopic treatment is not necessary; resection of ribs, recommended in extreme emphysema, can only rarely be justifiable.

MODE OF EXAMINATION.—Some details are important if treatment is to be successful. Details of the family history, of that of collaterals and of that of the individual, as to asthma, hay fever, eczema, gout, uric acid, epilepsy, and idiosyncrasies in the matter of eggs, shellfish, fish, and animal "emanations," are valuable as giving a gauge of the inveteracy of the disease and of the rigour and probable prolongation of treatment. For a like reason the duration of the disease, the severity, duration and frequency of the attacks must be ascertained. Specific questions must be asked as to periodicity; are the attacks nocturnal or week-end, or both? If mainly week-end, the case is likely to be easily cured. A history of hæmoptysis, especially if combined with fever, will put one on the alert for concealed phthisis. A minute record should be taken of the daily and week-end habits of the patient; also, of how many meals he takes and at what intervals; what he takes to each meal, how it is cooked, how he eats, what he drinks, what he does as to work and exercise. Until all this is known, treatment is likely to be a comparative failure.

The general appearance is to be noted. Is there cachexia, leanness or obesity; rounded shoulders, adenoid aspect, mouth-breathing? The tone of the voice will often indicate nasal obstruction. The presence or absence of rickets ought to be noted, the knee-jerks tested. The weight is noted and dated; this is absolutely essential, as will appear.

Detailed examination of the digestive, respiratory and circulatory systems and, lastly, of the urine, is then made, and in this order.

DIGESTIVE SYSTEM.—It is easy to look at the tongue without noting the condition of the teeth, but not *vice versa*. Are the teeth efficient for triturating the food so that the work of the stomach will be minimised; are there caries and pyorrhœa as sources of continuous poisoning and of gastric irritation? (Dental defects must be promptly remedied, for sloppy foods and fluids with meals are not allowed; it is best to decline treatment where the patient will not see to his teeth.) Inquire as to flatulence and gauge the successfulness of treatment as much by the disappearance of this as of the paroxysms. "Biliousness" or "bilious vomiting" is often the penalty of dietetic sins. Of course the possibility of gall-stones must be kept in mind; but serious organic disease is rarely found in the digestive system. When colitis is present it is often difficult to handle and it injures the prognosis of the asthma. Constipation always calls for correction.

In the *respiratory system*, setting aside for the moment nasal conditions, the presence or absence of emphysema is the most important point to note. If between spasms the cardiac dullness is gone and the upper border of the liver dullness is lowered to near the costal margin the case may improve, but is not likely to get well. Do the lungs move equally well? If there is defective movement on one side, is that due to collapse, concealed phthisis, or ipsolateral nose-block? Are the chest-walls mobile, deformed by rickets or pronounced emphysema? Is the respiratory expansion, measured at nipple and xiphoid levels, good? Note of these measurements should be taken so as to enable one to judge of the progress made under respiratory exercises.

Most important of all is the state of *the nose*. If the patient is a child with mouth-breathing there will almost certainly be enlarged tonsils and adenoids; the adenoids at least must be dealt with surgically. In such cases the teeth will be irregular, the palate narrow, the septum will show commencing deviation, the middle turbinals will be full and leaning on the septum. In older patients the presence of polypi, of sinusitis, of atrophic rhinitis may call for note, or there may be nasal obstruction from enlarged turbinals and deviated septum. None of the turbinals ought to touch the septum. The irritability of the septal tubercles ought to be tested by light friction with a small, dry cotton-tip; this may evoke coughing or sneezing, in which case it is usually good treatment to cauterise the tubercles at intervals of a fortnight or so. The examination of the nose so far has been done without cocain. Now a 10 per cent. or 20 per cent. solution of cocain, with the addition of a little adrenalin if necessary, should be used on a cotton-tip to explore the deeper parts of the nose. The exact size of septal spurs and deviations, the presence of moriforms, may thus be revealed and one can thus better gauge the amount of turbinal excess and the extent of polypoid degeneration.

With respect to the *circulatory system* the condition of the arterial walls and the blood pressure are to be noted; next, the condition of the heart.

The condition of *the urine* as to quantity, albumen, urates, uric acid and oxalates must never be missed.

These points of examination are not set down as a mere matter of form; they are essential to a proper handling of each case; but where circumstances compel a hurried examination the points which most demand attention are in respect of nose, teeth, emphysema, flatulence, constipation, urine, weight, diet and exercise.

After the examination the first thing to do is to explain to the patient that asthma is a toxæmia and that the object of radical treatment is to enable him to get rid of this and so to prevent the asthmatic paroxysms; that direct treatment to these is merely symptomatic and will only allay them for a time. This is important, because these patients, after having tried all sorts of nostrums and had prolonged nasal treatment, are often hopeless, and this hopelessness must be broken down by explaining why such treatment could not permanently succeed. The explanation of the basis of treatment is also important by way of getting them to carry out instructions. A patient made to see that not only does the paroxysm stop feeding but that stopping feeding stops the paroxysm, will the more readily fast voluntarily at regular intervals in order to prevent the spasms. Especially is this so in week-end asthma. Starvation always seems a heroic measure to a thin, cachectic asthmatic and his confidence can be gained in this way; only, the word starvation must not be used; else he is not likely to return for further treatment. Roughly, it may be said that the same regime holds for the asthmatic as for the consumptive except that stuffing is absolutely forbidden.

It is explained to the patient that as it takes five to six hours to digest a meal, that interval must be observed between meals and that hence only three meals are allowed in the day. As the first meal digests most quickly it should be ample and should be about 8 A.M.; dinner at 1 P.M. may also be a full meal; supper should be light and not later than 7 P.M. A rest after each meal should be taken if possible.

All food is to be thoroughly masticated and reduced to pulp in the mouth. As, with slight exceptions to be mentioned, liquids with meals and sloppy foods are not allowed, the patient is not likely to overeat and no restriction is put on quantity except at the evening meal. The greater the quantity of food taken the greater must be the amount of open-air exercise, In refractory cases of asthma it sometimes succeeds to limit the meals to two a day.

There is no restriction as to taking mixed meals, but there is to be no mixed cookery; the whole art of cookery for the asthmatic is the preparation of dishes at once palatable yet easy of digestion. Carbohydrates are not to be cooked with fats or with nitrogenous foods like milk and eggs; such mixture seriously impedes salivary digestion, as anyone can tell by his own sensations who will eat, one day, rice boiled twenty minutes in water and steamed two hours, and the next day, rice cooked in a medium of milk and eggs. The latter takes hours longer to digest, and is a much heavier meal than even water-boiled rice to which custard has been added just before serving. For a like reason pastries and suet puddings are tabooed. Idiosyncrasy for eggs, fish, etc., must always be ascertained. As an indication for the diet during the first few months the following is suggested:

Breakfast, 8 A.M. Eggs, scrambled, lightly poached or lightly boiled. (The best way to boil an egg is not to boil it, but to put the egg into at least a pint of boiling water and at once set the pan aside on the hot plate for ten minutes; the egg is always correctly cooked.) A little really good bacon is allowed. Fish are best taken baked with a little butter; but usually they may be allowed boiled, steamed or fried. Chicken roasted or boiled. Fresh fruit may be taken at this meal; but here also idiosyncrasy must be watched. Bananas are forbidden. A little jelly, not jam, and marmalade without peel may be allowed. Bread is to be stale, toasted if preferred, buttered when cold. Certain biscuits are allowable, but no pastries, no unleavened bread, no rolls; above all, no hot rolls. Oatmeal porridge is not allowed at first; usually it is taken with milk and never chewed but simply gulped.

Later, if allowed, it is to be eaten without milk but with a little sugar if desired and the result carefully watched. If tea is taken it should be after a meal and always China tea, which of all the xanthin beverages is the least harmful and interferes less with digestion than the harsher Ceylon and Assam teas. It should be infused not more than two minutes; one or two cups may be taken. Cocoa and chocolate are forbidden. Coffee is often prescribed for asthma; it should be proscribed, because not only is it specially rich in the methyl purins, which we wish to avoid in a disease where there is already difficulty in purin metabolism, but also because it is a nervous stimulant and because it impedes digestion. Milk may be taken at the end of the meal if desired, but in many cases asthma is kept up by excess of milk as well as by what are called milk foods. To aid its digestion three grains of citrate of soda may be added to each ounce of milk, or it may be fermented. Hot milk is forbidden; hot milk at bedtime is poison to asthmatics. The following milk recipes may not be amiss:—

Important

IRISH MOSS

A tablespoonful of Irish Moss rinsed under tap, put into cupful of cold water for about 15 minutes till it swells. Remove from water and add to pint of milk with sugar and flavouring (essence of lemon, vanilla or cinnamon); boil one minute, strain into mould, and allow to cool.

MATZOON

Half a cake (about two tablespoonfuls) of compressed yeast to be broken up and added to a pint of fresh milk warmed to 100 deg. F. (blood heat). Set aside in a jug covered with wet cloth in a warm place (a kitchen will do) for 12 hours. The milk will be fermented but too bitter for use; take half of it and add to another pint of fresh, warmed milk and treat as before for 12 or 24 hours. When fermented this is still too bitter, and only half of it is saved and added to another pint of fresh, heated milk as before. This in 12 to 24 hours should have a slightly acid, pleasant flavour and is ready for use, but a third should be saved to start next day's fermentation, and so on for about a month without the use of fresh yeast. Matzoon is at its best in the second and third weeks. *The fermented milk should be well stirred into the fresh milk.* It is best eaten with a spoon like soup; may be sweetened with sugar. On adding the fermented to the fresh milk stir well, and give an occasional stir during the fermentation (from Thompson's monograph on Grave's Disease).

About 11 A.M., one or two tumblers of water; if no tea has been taken to breakfast it may be taken now, but water is preferable.

Dinner, 1 P.M. Three or four courses are sufficient. A small quantity of any clear meat or vegetable soup that will pass through a strainer. No legume soups; as peas, beans and lentils, though nutritious, put a decided tax on digestion. Fish, cooked as already stated. Roast chicken, hot or cold. Beef or mutton, hot or cold, grilled or roasted, not stewed or fried. If meat is to be boiled it should be put for a minute into water briskly boiling and then set aside to simmer for three or four hours. Meat from which soup has been made is not to be taken, Once a week, if the asthma is improving steadily, jugged hare or rabbit or fore-ribs of mutton cooked in a "Boila" without water may be risked. Dishes like Irish stew are always to be avoided. Potatoes are often forbidden, but if well cooked, preferably in their skins, and well masticated, may be taken with gravy or butter. If potatoes are forbidden to special cases, rice or bread may be substituted. Vegetables, if well cooked so as to pass through a sieve, may be allowed in small quantity. No pastries.

The dessert is perhaps the most difficult part of the meal to arrange. As already stated, milk-boiled puddings, steam and suet puddings, are forbidden; also cornflour and arrowroot if made with milk. Rice, sago, tapioca, may be taken if boiled with water and eaten with fruit or sugar but without milk to ensure proper mastication. The following recipes are given as samples:—

To cook Rice

Wash in three waters, throw into plenty of boiling, salted water; boil 20 minutes, strain, butter bottom of pan, and line with buttered paper; put strained rice into this, put on lid and set on back of range to steam for 2 hours. Rice thus cooked may be eaten alone with salt and butter, or with meat, or with stewed fruit or jelly, or Demerara sugar. If any is left over, it may be used a second time by adding to it a custard made of two beaten eggs and one full cup of milk; yolks and whites to be beaten separately, and whites added last and lightly.

Flavour with grated nutmeg on top. This, though much lighter than milk-boiled rice, should not be used at the beginning of treatment.

SAGO

(1) Wash teacupful sago, boil 1 hour in four breakfastcupfuls of water (will boil in 20 minutes if soaked overnight). Add one cup golden syrup and the juice of a grated rind (the mere outside) of a lemon. Mix well, boil up once. Is nicest hot; but may be moulded cold.

(2) Soak teacupful sago overnight; slice three apples; fill small pudding bowl with apples and sago alternately; season with sugar and a little nutmeg. Steam 2 hours.

FAIRY PUDDING

Two tablespoons cornflour; three of granulated sugar; three teacups water, two eggs, one lemon. Put water, sugar, rind and juice of lemon on to boil. Moisten cornflour with a little water and add to boiling mixture. Boil a few moments, turn into a basin to cool. Whip egg whites very stiffly and add lightly and thoroughly. Pour into wetted mould till firm —an hour or two. A custard can be made with the yolks and a teacup of milk, if allowed.

Cooked fruits are allowed, but figs are best avoided at first; prunes are allowable if so cooked that they would pass through a sieve. Roasted apples are excellent. Some people seem to think that rhubarb is a fruit; if allowed at all, it should be of the "forced" early variety and in small quantity; strawberries, gooseberries and rasps are treacherous.

Nuts and the usual vegetarian's menu are tabooed; the flesh foods for which they are substituted are easier of digestion and less prone to cause flatulence. Cellulose is indigestible and should be kept at a minimum. Fluids are best avoided at this meal. Two cups of China tea may be taken at 3 or 4 P.M., without anything to eat.

Supper at 7 P.M. should be something like breakfast but less in quantity—say, fish or egg or chicken; bread and butter. Some preparation like Horlick's Malted Milk, Allenbury's Diet, Falliere's Phosphatine may be taken at the end of the meal or substituted for part or whole of it. A glass of hot water at bedtime. A fair amount of water, something like two pints daily, must be taken to procure due cleansing of the whole system.

Some general remarks may be made as to this diet. Some authorities would cut down the fats. In the case of obese asthmatics this is advisable, but it is perhaps less important than cutting down the carbohydrates. The majority of asthmatics, however, are not obese, for them a fair amount of fat is essential, and I have rarely found any objection on this scale. It will be noted that a fairly large amount of animal food is allowed. Some might object to this on the ground of raising blood pressure, but asthmatics have not as a rule high pressure; even in those cases where the pressure is up, it is not necessary to cut down the animal food to any great extent so long as periodic starvation is enjoined.

Fasting.—Where the asthma is pronounced, the patient must fast one day a week. For the last ten years I have usually got patients who liked it to take nothing but buttermilk every Sunday for four weeks. They may also take water, hot or cold, and, once or twice in the day, weak tea. At the end of four or six weeks the asthma is usually much less severe and frequent ; the fasting day may then occur less frequently, once a fortnight or month ; more frequently, if the asthma does not show signs of clearing up or if it threatens to relapse. If the asthma has gone, the patient will be well advised to have a systematic fasting day once in three months at the outside. Where the patient does not like buttermilk he may take fermented milk or skim milk or hot water and weak tea. Raw milk is often as treacherous as alcohol to asthmatics. Alcohol is only for the aged asthmatic. If it is difficult to induce the patient to fast so rigidly, a compromise may be made by allowing one meal of water-boiled rice eaten with butter ; as he improves, a little lean meat or fish may be added on the fasting day. I have for many years proved the value of fasting in asthma ; recently Guelpa has shown its value in various diseases, particularly glycosuria. In his book are recorded several cases which read like asthma, though not so called, and successfully treated. Much of what he says on the renewal of the tissues by this means is of value in relation to asthma.

This periodic fasting must be carried out judiciously and with an eye on the patient's weight, which at first must be taken weekly. If the patient is obese loss of weight is a decided gain ; if he is of the thin type the loss of a few pounds during the first fortnight need not excite alarm, for it is usually made up, and ought to be made up, in the succeeding weeks.

A patient who fasts at week-ends will eat more between them and will metabolise it properly if he has sufficient open-air exercise ; but it is wise to watch the weight lest the patient become tubercular long before the doctor has made the diagnosis. This is no imaginary fear. Cachectic asthmatics usually show within the first few weeks a distinct clearing of the skin and acquire a feeling of well-being to which they have been long strangers. It is then they begin to put on flesh ; if they do not, or at any rate if there is continued loss of weight, there is something wrong with the treatment, with the way in which it is being carried out, or there is some complication.

This combined system of regular diet and regular fasting is the most important element in the treatment of the toxæmic factor in asthma. It at once diminishes the severity and frequency of the paroxysms ; it conforms with Nature's mode of cure.

The same rules of diet apply to children as to adults ; but children are not to fast, though they may have a day of reduced diet now and then. With them as with adults patience pays ; they may improve promptly within the first month, then have occasional relapses during the next few months ; but the paroxysms become less and less frequent and usually by the end of a year they quite disappear.

Essential measures in antitoxæmic treatment are such as will increase active oxidation of the tissues, and hence stimulate metabolism of the food by the tissues, and such as will reduce the bacillary content of the bowel and therefore reduce toxic absorption from the bowel.

For the first, active open-air exercise is necessary.

The life of the asthmatic should be much the same as that of the convalescent consumptive: windows open night and day, rooms as free of dust as possible, not less than two hours open-air exercise daily. If this cannot be taken at any other time it can be taken in the evening. There is a mistaken idea that night air or rain is harmful to asthmatics. They ought to be encouraged to go out in all weathers except fog and storms; a walk at night will often procure a quiet night without the dreaded attack. The patient should be encouraged to devote at least some hours every week to some outdoor sport or game; fishing, golf, etc., as may be suited to his age and inclination. One young man who was a martyr to asthma became so convinced of the importance of an outdoor life that he took up horse-rearing in the uplands of Yorkshire and became cured. I wish to repeat, however, that no asthmatic need fear living in any place provided it is not too damp and his nose is right; in this last proviso I would include hay fever.

Sometimes, especially in weak cachectic cases, decided help may be got from the inhalation of oxygen. A litre may be inhaled, three or four times daily—say, after meals and at bedtime; this may with advantage be continued for two or three months at the outset of treatment. Often the cheapest way to do this will be for the patient to buy the cylinder valve and inhaling bag, and get the cylinder refilled when necessary. When done with the apparatus he can sell it.

As an aid to this increased oxidation, to the overcoming of the asthmatic's oxypathy, as Stoeltzner would call it, respiratory exercises should be prescribed. It is no use prescribing many and elaborate exercises, for they will not be long continued by any patient on account of weariness or lack of time. Two are sufficient and do not take up more than five or ten minutes ; they are done in the morning before dressing and in the evening after undressing. Both are done with the mouth shut during inspiration and expiration.

For the first the patient lies on his back on the floor with the palms on the front of his thighs ; he takes a long, deep breath, holds it, then slowly rises to a sitting posture and slowly exhales. He then takes another deep breath and slowly lowers himself to the original supine position and slowly exhales. This double exercise is done ten times, not more. At first five or six times may be enough and some resistance over the feet to assist the patient to rise may be necessary. Where the patient is not able to do the first part of this exercise he may begin in the sitting posture, inhale and slowly lower himself and recover the sitting posture with the aid of a friend's hand.

For the second exercise he " hunkers," as a miner would say, but on tiptoe, with his hands above his head, tips of the fingers together, rises quickly to his full height, at the same time inhaling deeply and quickly, flinging his hands backwards and downwards so that the backs of the hands meet behind the hips. He then returns quickly to the original position, exhaling deeply. The double movement is done ten times, quickly, and on tiptoe throughout.

These exercises not only ventilate the lungs thoroughly but aid muscular metabolism and development ; they help especially to strengthen the respiratory and abdominal muscles; they help to counteract constipation. They should be done with the window open.

The clothing should be light but warm; the patient should not be burdened with heavy neckwear or greatcoat; in wet weather he should have a light waterproof; boots to be changed daily. Every morning he should have a warm bath with a good soaping, followed by a cold spray or cold sponge and brisk towelling so as to get a good reaction.

In drugs we have another aid to antitoxæmic treatment. Every patient is given at least once a week, and sometimes twice, a mercurial. In children and in adults with constipation:

Calomel. .	gr. ¼ to gr. 2
Sacch. Alb. .	q.s.

This is given on the tongue at bedtime at the week-end, usually on the evening before the fasting day; sometimes on the morning of that day. In adults without constipation Pil. Hydrarg. gr. 3 is substituted, followed by a mild saline next morning. This mercurial treatment is continued for years, if not for a lifetime, and is the only drug treatment that usually need be continued.

Often it is advisable, especially where there is flatulence and digestion is not active, to give a stomachic. The best I have found as a routine is:

P. Rhei. .	gr. 3
Bism. Salicyl. .	
Sod. Bic. or Magn. Carb.	
Maltopepsyn .	aa. gr. 10

To this may be added with advantage P. Taka diastase gr. 2 and, if there is constipation, phenolphthalein gr. 1, or iridin gr. ¼ with aloin gr. ¼.

This powder, or half of it, may be given in cachet or wafer, once, twice or thrice daily after meals. It is best to give a course of a dozen powders, and then to give them less frequently, and ultimately only occasionally, as the patient feels the need. Physiologists often tell us that such digestive ferments as pepsin, pancreatin, etc., are useless. They would become less dogmatic if they tried on a few cases the above prescription with, and then without, the digestive. Patients at once say they know the difference in result though unaware of the difference in make-up.

Sometimes in cases of marked flatulence charcoal gr. 30, betol gr. 2, twice daily, say at 11 A.M. and 7 P.M., for a week or two is an advantage, but usually more good is got from a saline, especially a sulphate. This is particularly the case where there is reason to suspect intestinal toxæmia from intestinal putrefaction ; where the blood pressure is high, where the patient complains of headache, cold feet and bilious attacks, and where there is distinct odour from the skin and breath. The following combination is useful :—

Mag. Sulph.
Sod. Sulph.
Sod. Bic.
Sod. Phosph. aa.

Half to two teaspoonfuls in a glass of water, hot or cold as preferred, first thing in the morning.

The weekly, or bi-weekly, mercurial should be given in addition, for, not only is it the best intestinal disinfectant, but it powerfully affects metabolism.

Another way of diminishing the intestinal flora is to keep the patient for two or three days on a purely nitrogenous diet and then change to a purely carbohydrate one for a similar period; using a mercurial purge before, between and after; but this is not a plan to be frequently tried or repeated.

Treatment for the Paroxysm.—The antitoxæmic treatment above outlined is the most important part of the treatment for the asthmatic. It secures a comparatively clean digestive tract from teeth to anus; it aids tissue respiration and metabolism, and promotes energy; it abolishes the need for continued drug treatment for the spasms, which steadily become fewer and less severe. But at first such drug treatment is absolutely necessary. The following mixture is given from the beginning, and rarely fails to help the patient:—

Tr. Bellad.	.	m. 10
Pot. Iod.	.	gr. 10
Liq. Ars.	.	m. 2 or 3

This for a dose made up with some digestive or a bitter.

It is given every four hours if the asthma is bad; otherwise, thrice daily, an hour after food, for the first two or three weeks; then twice daily for a like period; afterwards once daily for the same period or longer, but always so that the last dose is at bedtime. When the asthma threatens to relapse the more frequent doses are resumed.

Belladonna (atropin) is the best drug for combating the spasm ; it, or some ally of it, such as stramonium, is the basis of all nostrums for asthma. Experimentally it has been shown to prevent the induction of bronchial spasm or to allay it when induced. Arsenic is a powerful "alterative" to tissue metabolism and is specially indicated in cachectic cases. The Styrian peasants have shown its value in promoting "long-wind." Iodide is another great help to tissue metabolism and in combating toxæmia. Inability to take it on account of iodism is a serious drawback in the handling of asthma. In such cases some of the newer organic combinations, such as iodipin or iodoglidin may be tried, or the strontium salt, the arsenic and belladonna being given in separate mixture.

The above mixture is not given on the fasting day, and only a morning dose on the day when the mercurial is to be given in the evening.

Where the spasm demands instant relief, 5 m. adrenalin (1·1000) hypodermically, repeated in twenty or thirty minutes if necessary, is usually successful. If not, a hypodermic of morphia will probably attain the desired result ; it is sometimes combined with adrenalin. I have seen 4 or 5 grains of Dover's powder, with 6 grains of phenazonum act like a charm. But neither morphia nor adrenalin should be frequently given ; first, because they are symptomatic treatment and the need for their frequent repetition indicates that the radical antitoxæmic and nasal treatment is not being properly carried out ; and, secondly, because the frequent use of either drug is harmful. /Adrenalin comes to have a sclerotic effect on the arteries, and I have known the use of opium or morphia in asthma to induce the opium habit. The narcotic should never be prescribed to the patient, but always used by the doctor himself, and injected hypodermically. There is one time above all others for the use of morphia in asthma, and that is when the patient is kept awake all night, and night after night, by the paroxysms and gets what sleep he can during the day. He is thus prevented getting open-air exercise and improved tissue-oxidation. He should have a dose or two of morphia hypodermically or in suppository at bedtime so as to allay spasm and procure sleep and, if possible, get out of doors next day. If the diet is properly managed, a purgative and the belladonna mixture given, the morphia will not require frequent repetition.

Help may sometimes be got in a bad paroxysm from a hot poultice of mustard bran (the best of all poultices) wrapped in flannel and applied over the whole back for twenty minutes, for thirty if the patient's skin will bear it. As it flays children, it should never be applied to them. When some indiscretion in diet has been the exciting cause of the attack it is wise to start treatment with a saline purge. Emetics I seldom give ; I have tried apomorphine, but the remedy is apt to be thought worse than the disease.

If the patient has been in the habit of using asthma cigarettes or inhaling the fumes of the many asthma powders on the market or the spray of a specific remedy from an atomiser, I never forbid them. They often alleviate the spasm, often fail ; they never cure asthma ; they merely treat the symptom, not the disease. Unless there are serious complications, radical treatment never fails to alleviate and mostly cures. I have sometimes found the following cigarette useful; it is not suggested as being better than any of the cigarettes on the market :—

Lobelia	2 parts
Stramonium	2 parts
Nitre	1 part
Virginian Tobacco	q.s. to make a cigarette
Atropin Sulphate	gr. $\frac{1}{100}$

It is sometimes asked how such cigarettes, based on a non-volatile alkaloid (atropin, hyoscin, daturin), act, whereas nicotin is a volatile alkaloid. But the alkaloids of opium are not volatile and yet "act" when smoked in an opium pipe. In none of these cases is it the part of the drug that is being burnt from which the alkaloid is given off, but the hot part nearer the smoker.

A dozen years ago I suggested the following to be used from an atomiser. It does not seem to be so strong as the well-known "cure" of which it is an imitation but it is often quite as effective :—

Cocain Hydrochlor	1 per cent.
Sod. Nitrit	7½ per cent.
Hyoscyamin Sulph.	0·2 per cent.
Atropin Sulph.	0·5 per cent.
Glycerin	1·5 per cent.
Sacch. Ust.	q.s.
Ol. Gaultheriae	trace
Aqua	1 oz.

But as already hinted, these inhalations and sprays are rarely needed by any asthmatic after the first six weeks of treatment, during which the belladonna mixture is to be taken alongside antitoxæmic and nasal treatment. Some patients become slaves to these proprietary cures and can with difficulty be persuaded to give them up. One lady, though immensely improved by the treatment above outlined, would not stop having a few whiffs of her spray after each meal. I gave her the last-mentioned prescription to be used in her nebuliser; she said it did quite as well as the expensive "cure" she had been using. On repeating it I omitted the alkaloids and nitrite without letting her know; it continued to have the same beneficial effect. There is no doubt a psychical element in some cases of asthma (Saenger). The chronic asthmatic becomes so obsessed by the inevitability of a spasm after a meal that he develops wheezing by expectation. Hypnotism might help such cases; I offered to try it for the lady just mentioned, but she declined.

Often an attack can be stopped by the application of cocain hydrochlorate (10 to 20 per cent.) with a little adrenalin (1-10000) on a cotton-tip to the interior of the nose; the same may be gently swobbed inside the larynx, taking care to guard against excess of cocain.

Nasal Treatment.—From the outset of treatment the nose and throat should be put in order; polypi removed, suppurating sinuses drained, septal spurs and deviations removed, hypersensitive areas cauterised, enlarged turbinals reduced, enlarged tonsils and adenoids removed. In short, nose-block must be abolished, free air-way established and all sources of intranasal irritation removed, so that all chances of nasal stimulation of the bronchial muscles and of irritation of the bronchial mucosa shall be reduced. If nothing abnormal is seen inside the nose the septal tubercle may be cauterised, as Francis suggests, but more especially if it is large and fleshy or if tickling it with a dry cotton-tip provokes sneezing and coughing. A fortnight later the other tubercle may be cauterised and the process repeated to each at similar intervals. The result is sometimes astonishing, and it gains time for the radical treatment to take effect. This procedure should always be tried where the asthma is refractory. In adults submucous resection of the septum is equally or more satisfactory. It is an operation too much done nowadays, but not in asthmatics where there is any indication for it.

In children the septum should rarely, if ever, be resected ; an exception may be made where the lower part of the quadrangular cartilage obstructs the nostril in old-standing cases of fracture. Resection of a child's septum is apt to interfere with due development of the nose. More good on more rational lines is likely to be got, after the removal of adenoids and tonsils if necessary, by orthodontic methods. If the teeth are irregular and badly placed, if the bite is such that the cusps of the lower molars do not bite within the cusps of the upper, so as naturally to keep widening the growing palate—in other words, if the arch of the palate is Gothic rather than Norman in type, the child should be sent to a capable dentist familiar with orthodontic methods.

Orthodontia is difficult and, if not carefully supervised, apt to be harmful by tilting the teeth and setting up pyorrhœa ; but during the last year or two I have been delighted, as have been my patients' guardians, whenever I have tried it. All the patients speak of the improvement in nasal breathing ; the improvement in facial contour is obvious to anyone. It must be emphasised that the removal of tonsils and adenoids is not sufficient for such cases. Too often this is all that is done ; whereas in children over 6 years of age, and even earlier, it should be in many cases merely the preliminary to proper dental methods.

In conclusion, it may be freely affirmed that where all the elements of the above treatment necessary to the individual case are thoroughly carried out, there are few cases of asthma that will not yield. Cases of not more than a few years' standing will yield within a month or two ; very chronic cases will show improvement within the same period, and the improvement in the appearance of the patient is often as astonishing to the patient's doctor as to his friends ; but it may take many months before he is quit of his asthma. Such cases must persevere with all the hygienic measures mentioned, and take the belladonna-iodide mixture as the occasion demands. Relaxation as to diet must be done guardedly ; the weekly mercurial is never to be omitted. The complications referred to in the previous chapter embarrass the treatment, and seriously damage progress ; even they may be overcome and must be dealt with *secundum artem.*

The treatment of atypical asthma will be on similar lines and has already been sufficiently indicated. The preventive treatment is the main thing. Probably during laryngismus the application of 5 per cent. cocain with a little adrenalin on a swob to the larynx, the left forefinger being used as a guide, would be found effectual. The treatment of acute pulmonary oedema, in so far as it is of toxæmic origin, and of acute circumscribed oedema, will be on the same preventive lines as in asthma.

REFERENCES

Adam. "The Nature and Treatment of Asthma." *Glasgow Hosp. Reports*, 1901, pp. 151-201.

—— "Clinical Evidence for a Toxic Factor in certain Diseases." *Brit. Med. J.*, 9th May 1903.

—— "A note on Turbinal and Sinus Function." *J. of Laryng., Rhin. and Otology*, June 1911.

Barber. "Paroxysmal Attacks of Dypsnœa at Night in Heart Diseases." *Brit. Med. J.*, 1911, ii., p. 1592.

Berkart. "Bronchial Asthma" (1911).

Bouchard. "Auto-Intoxication in Disease." Oliver's trans. (1894).

Brodie and **Dixon.** "The Pathology of Asthma." *Trans. Path. Soc. of London*, vol. liv., pp. 17-39.

Brünings. "Direct Laryngoscopy." Howarth's trans.

Burian and **Schur**, quoted by Walker Hall in "Purin Bodies."

Campbell, Harry. "Respiratory Exercises in the Treatment of Disease."

Cocks. "Contribution to Pathology and Clinical Diagnosis of Status Lymphaticus." "Laryngoscope," 1912, p. 997.

Dunbar, quoted by Yonge in "Hay Fever and Paroxysmal Sneezing"; also the current medical literature.

Edgeworth. "General Subcutaneous Non-Renal Oedema as a Familial Affection."

Francis. "Asthma in Relation to the Nose" (Adlard).

Frendenthal. *Journal Laryngol.*, 1911, p. 537.

Gee, Samuel. "The Lumleian Lectures on Bronchitis, Pulmonary Emphysema and Asthma 1899." *Brit. Med. J.*, i., p. 75.

Gillette, quoted by Goodall.

Goodall. *Brit. Med. J.*, 1911, i., p. 292.

Goodhart. "Allbutt's System of Med.," 1898, p. 287.

GOODHART and SPRIGGS. "Allbutt's System of Med.," 1909, p. 45.

GUELPA. "Autointoxication et Désintoxication" (Doin), 1910.

HALL, WALKER. "Purin Bodies" (1903).

HALSTED. "Laryngoscope," 1909, p. 525.

HARE, FRANCIS. "Mechanism of the Paroxysmal Neuroses," p. 12. Reprint from *Australasian Med. Gaz.*, 1903.

HERTZ. *Clinical Journal*, August 1910, p. 263.

HUTCHINSON, WOODS. "Studies in Human and Comparative Pathology," p. 164.

KEITH, ARTHUR. "The Mechanism of Respiration in Man." "Further Advances in Physiology" (1909), p. 182.

LAZARUS. "Experimentelle Untersuchungen zur Lehre von Asthma bronchiale." *Deuts. med. Woch.*, 1891, xvii., p. 852.

MACKENZIE, JAMES. "The Pulse," p. 170; "Diseases of the Heart," pp. 28, 29.

MACKENZIE, MORELL. "Hay Fever."

MELLAND, on "Adrenalin in Asthma." *Lancet*, 1910, i., p. 1407.

PERCEPIED. "Considerations on the Spasmodic Coryzas." *Rev. Hebd.*, April 1912, p. 417.

SAENGER. *Berl. Klin. Woch.*, viii., 1912.

SAHLI. "Diagnostic Methods." Kinnicutt and Potter's trans. (Saunders), pp. 585-590.

SALTER, HYDE. "On Asthma" (1868).

STENGEL. *Amer. J. Med. Sc.*, January 1911.

STOELTZNER. "On Oxypathy." *Brit. Med. J.*, vol. ii., 1911.

WATSON-WILLIAMS. *Practitioner*, October 1910, p. 527.

WHITING. *Lancet*, November 1908, p. 1356.

WILLIAMS, C. J. B. (1840). *Brit. Assoc. Rep.*

WOLEY. *Jour. Amer. Med. Assoc.*, July 1910.

YANKAUER. "Laryngoscope," 1910.

YONGE. "Hay Fever and Paroxysmal Sneezing."

INDEX

ADENOIDS in relation to diet, 93
Adrenalin, action of, in checking spasm, 26; action of, Melland's theory of, 27; effect of, in asthmatic attack, 15, 24; use of, in treatment, 171; failure of, 38
Age incidence in asthma, 106; influence of, on prognosis, 128
Albuminuria in acute attack, 29, 60; periodic, 51; character of, in asthma, 125; and prognosis, 142
Amins producing asthmatic symptoms, 114
Anaphylaxis in asthma and allied conditions, 71, 72; question of inheritance of, 105
Anorexia during attack, 28
Antitoxin, danger of, in asthma, 71, 72, 73
Anuria during attack, 10
Arterio-sclerosis absent in chronic asthmatics, 38
Asthma, acute, 7 *et seq.*; atypical, 63; cardiac, 126; chronic, 30 *et seq.*; laryngeal, 65; renal, 125; senile, 129; thymic, 127
Atropin as antagonist to asthmatic spasm and spasm-producing poisons, 111, 115, 171, 173
Attack, asthmatic, description of, 8, 9
Atypical forms of asthma, 63

BARBER, 126
Barger and Dale, on action of amins, 114, 115
Berkart, shifting of rales during attack, 85; on origin of asthma, 35; post-mortem appearances in asthma, 117; pyrexia in asthma, 63; rickets and asthma, 67
"Bilious vomiting" in asthmatics, 154
Blood-count during attack, 28
Blood pressure during attack, 21 *et seq.*; low, in asthma, as aid to diagnosis, 125
Bosworth, importance of nose in respiration, 90
Bouchard's experiments with day and night urines, 28, 45
Brodie and Dixon, experimental production of bronchial spasm, 82; muscarin causing bronchial spasm, 111; relative force of inspiration and expiration, 83; theory of asthmatic dyspnœa, 75
Bronchi, morbid changes in, due to dyspnœa, 116
Bronchial spasm caused by muscarin, 111
Bronchiole spasm insufficient to explain dyspnœa, 86
Bronchitis, recurrent, in children a form of asthma, 63
Brünings, bronchoscopic observations, 77
Brunton, muscarin as decomposition product, 111
Burian and Schur, 53

CACHEXIA, asthmatic, 31; its disappearance under treatment, 110, 165
Campbell, comparison of inspiratory with expiratory force, 83
Carbohydrate excess a factor

Carbohydrate excess—*continued*
in asthma, 5, 44; excess a factor in tonsillar hypertrophy, 93; in the bronchitis of children, 65; in laryngismus, 65; intake disturbing nitrogenous output, 56; fever, Hale White, 63
Cardiac asthma, description of (Fraenkel), 126
Charcot-Leyden crystals, description of; 20
Checking of acute attack with adrenalin, 15
Chest, changes in, due to dyspnœa, 35
Chloasma in chronic asthmatics, 31
Circulation in acute attack, 21; in chronic asthmatics, 37
Clarke, cause of bronchial spasm in asthma, 77
Climate and asthma, 102
Cocks, 127
Colitis, relation to asthma, Hertz, 29, 39
Collapse, pulmonary, 141
Cords, vocal, during acute attack, 12
Curschmann's spirals, description of, 17, 18; origin of, 19

DERMATITIS associated with chronic asthma, 34
Desquamation in asthma, 11
Diagnosis, 124
Diaphragm, spasm of, in asthmatic dyspnœa, 79
Diet for asthmatics, 157 *et seq.*
Digestive system during attack, 28, 29
Dunbar, 100
Dunlop, 70
Dyspnœa, asthmatic, pathology of, 75; in acute attack, 9, 13

ECZEMA, frequency of, in chronic asthmatics, 33
Edgeworth, 73
Emanations and asthma, 102
Emerson, description of asthmatic sputum, 17, 18, 19
Emphysema affecting prognosis in asthma, 131, 141; development of, 35
Eosinophile cells in asthmatic sputum, 16, 20
Eosinophilia in allied conditions, 35; in anaphylaxis, in asthmatics, 73; in case of pulmonary oedema, 70; in hay fever, 98; in muco-membranous colitis, 40
Epilepsy, periodicity of, 47
Erythema and asthma, 11
Exercise, importance of, in treatment, 165
Eustis on intestinal toxins in asthma, 114

FACTORS in asthma, 2
Fasting, importance of, in treatment, 164
Flatulence, effect of, on prognosis, 142; frequency of, in chronic asthmatics, 39; treatment of, in asthmatics, 168
Flesh, factors producing laryngismus in children, 67
Formication in asthma, 10
Fraenkel, description of cardiac asthma, 126
Francis, nasal lesions in asthma, 91; cauterisation, 91, 175

GEE, on afebrile bronchitis of children, 63; pulmonary oedema and asthma, 69; on "pneumonic asthma," 86
Gerlach, origin of Curschmann's spirals, 19
Gillette, 72
Goodall, anaphylaxis in asthma and allied conditions, 72
Goodhart, morbid changes in bronchi in asthma, 116; the bronchi during asthmatic attack, 77
Gout, connection of, with hay fever, etc. (Yonge), 97
Guelpa, value of fasting, 164

Hæmoptysis during acute attack, 25; in asthma suggesting phthisis, 119
Hall, Walker, on purin bodies, 59, 60
Halsted, case of angio-neurotic oedema of bronchus, 87
Hare on asthmatic dyspnœa, 75
Hay fever, irritants producing attack of, 100, 101; relation of, to asthma, 94 *et seq.*
Heart in asthma, 25, 37, 116, 117
Heredity in asthma, 104 *et seq.*
Hertz, electrical stimulation of intestines, 82; spasmodic asthma and spasmodic colitis, 29, 39
Hoffmann, origin of Curschmann's spirals, 19
Hutchinson, black strangury in horses, 50

Ichthyosis associated with asthma, 34
Idiosyncrasy in asthmatics, 71 *et seq.*; 102, 105
Illoway, laryngitis and laryngismus stridulus, 65
Indigogens, increase of, in urine, during attack, 29
Influenza and asthma, 107
Inspiratory difficulty during attack, 13
Intestinal toxæmia in asthma and bronchitis, 63, 114, 115
Iodides in asthma, 171
Irritants, nasal, effect of, in asthmatics, 9

Keith on respiration, 84
Knee-jerks in asthma, 28, 81

Laennec, perles of, in asthmatic sputum, 16
Laryngismus stridulus, relation of, to asthma, 65; treatment of, 177
Laryngitis, spasmodic, relation of, to diet, 65
Laryngitis stridulosa, 65, 66
Larynx, tumefaction of, in laryngismus, 66
Laughter producing asthma, 79

Mackenzie, pulse during attack, 25; cardiac asthma, 126
Mackenzie, Morell, hay fever, 99, 100
Meals, limitation of number of, in treatment, 157
Mediastinal tumour, diagnosis of, from asthma, 127
Melland, action of adrenalin during attack, 27
Mercury, use of, in treatment, 168
Monday morning disease of horses, 50
Morphia, use of, in acute attack, 171
Mouth breathing a hindrance to cure in asthma, 92; as affecting prognosis, 141
Muscarin, experimental production of asthma by, 111

Narcotics in treatment, 172
Nasal factor in asthma, 89 *et seq.*; obstruction, unilateral, effect of, in asthma, 14; treatment in asthma, 174
Nervous system during attack, 28
Neurosis, asthma as a, 3
Nose in acute attack, 12

Oedema, acute pulmonary, relation of, to asthma, 69; angio-neurotic, of bronchus, 87; angio-neurotic, production of, 73; angio-neurotic, treatment of cases of, 74; cutaneous, periodicity of, in a case, 48, 49; in relation to toxæmia, 113
Oliguria, characteristic of asthmatic attack, 29, 58
Organic disease as affecting prognosis in asthma, 129
Orthodontia, 175, 176
Oxygen, inhalation of, in treatment of asthma, 166

PERCEPIED on spasmodic coryzas, 94; heredity in cases of hay fever, 97
Periodicity of asthma, 41; explanation of, 43; in other diseases, 47 *et seq.*
Petechiæ in acute attack, 9, 11, 25
Phthisis as complication of asthma, 119 *et seq.*
Place asthma, 101
Pneumonia and asthma, 107
Pollantin, effect of, in hay fever, 100
Polyuria preceding attack, 10, 28
Post-mortem appearances in asthma (Berkart), 117
Prodromata of attack, 10; nervous element in, 28
Prognosis in asthma, 128 *et seq.*
Psoriasis, question of association with asthma, 34
Psychic factor in asthma, 102, 174
Pulmonary oedema. See Oedema
Pulse during attack, 25
Pupils in acute attack, 9
Purin bodies, diuretic effect of, 59; excretion of, in asthma, 24
Pyrexia sometimes present in asthma, 63; in asthmatic adults suggests phthisis, 119

QUINCKE's deep oedema, 49

RAYNAUD's symptoms in asthma, 10
Recipes for cooking in diet of asthmatics, 159 *et seq.*
Renal asthma, 125
Respiration, relative strength of muscles of, 83
Respiratory exercises for asthmatics, 167; respiratory tract in asthma, 12
Rhinitis, carbohydrate excess as a factor in, 93; hyperæsthetic (Percepied), 94
Rickets, question of relation of asthma to, 35, 36, 37, 67; and laryngismus (Flesh), 67

SAENGER, psychic factor in asthma, 102
Salter, hereditary factor in asthma, 104; on asthmatic physique, 36; on bronchial spasm as cause of asthmatic dyspnœa, 80; periodicity of attacks, 41; prognosis in asthma, 128; sex influence in asthma, 107; use of emetics in asthma, 29
Senile asthma, 129
Sex incidence in asthma, 108
Skin, affections of, in acute attack, 12; in chronic cases, 33; appearance of, in chronic asthmatics, 31; before and during acute attack, 10, 11
Spasm, bronchial, 5; laryngeal, 65
Spirals, Curschmann's, description of, 17, 18; origin of, 19
Sputum, asthmatic, description of, 15, 16; method of examining, 16
Stengel, paroxysmal pulmonary oedema, 71
Sulphates in urine of asthmatics, 56 *et seq.*

TEETH, condition of, as affecting prognosis, 141
Theories of mechanics of respiration, 82 *et seq.*
Thymic asthma, 127
Tonsils, enlarged, in relation to diet, 93
Toxæmia in asthma, 5, 45, 109 *et seq.*; in eczema, 33; in hay fever, 95 *et seq.*
Tubercle as a complication of asthma, 118 *et seq.*
Tuberculin, 119
Tyramin, 115
Tyrosin, relation of, to Charcot-Leyden crystals, 20

Uric acid excretion in asthmatics, 55
Urine, Bouchard's experiments with, 28, 45; changes in, in asthma, 53; diminution in amount of, before attack, 10; toxicity of, increased during day, 45
Urticaria in asthma, 10, 33, 73; relation of, to angio-neurotic oedema, 73

Vaccines in asthma, 4, 62
Van Noorden, origin of pigmented cells in sputum, 21
Vaso-dilating drugs, uselessness of, 24

Week-end periodicity of asthma, 42, 43; of epilepsy, 47; of urticaria, 49; of albuminuria, 51
Whiting, 73
Williams, Watson, theory of asthmatic spasm, 82
Woley, blood pressure, 22

Yankauer, state of bronchi during seizure, 76
Yonge, hay fever, 95; connection of hay fever with uric acid, eosinophilia toxæmia, 97

Zeyer on toxins in asthma, 114

Henry Kimpton, 263 High Holborn, London, W.C.